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CHICAGO OFFICE, - - - - - - - 936 Monadnock Block.
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T. C. MARTIN AND W. D. WEAVER, - - - - - - Editors.
T. R. TALTAVALL, - - - - - - - - - Associate Editor.
CARL HERING, - - - - - - - - - Special Contributor.

J. M. WAKEMAN, - - - - - President and General Manager.
T. C. MARTIN, - - - - - - - - - - Vice-President.
A. C. SHAW, - - - - - - - - - - - - Secretary.

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THE INDEPENDENT TELEPHONE CONVENTION.

If the figures of President Thomas and Mr. Critchfield, of the Independent Telephone Association, be accepted as approximately correct, there must be at least 300,000 subscribers served to-day by the independent exchanges, of which the number reaches fully 2500. In this branch of industry it is stated also that $55,500,000 is invested, to say nothing of the manufacturing plants. So far as we can determine, the figures of these gentlemen are in nowise an overestimate, and thus we have in "independent telephony" the biggest opposition that "monopoly" has ever encountered in this country. It is a marvelous growth, and in many respects the movement has been one of the most interesting and noteworthy of the last five years. The convention in Chicago last week showed that the business has gained enormously in strength, character and influence in a very short time. Probably there is nowhere a keener appreciation of this fact than within the Bell ranks, especially among those who do not wish to depend on "monopoly" and exclusive patents, but believe that in the long run the best and cheapest service must win.

The permanence of the independent system is the point that interests most people at the present time. As the service grows older there is a natural tendency either to drop out of the competition or to improve the apparatus and charge higher rates. As a general thing the natural inquiry arises, will the Bell rates decline much lower or will the independent rates gradually go up in these days of higher price for everything? And when the rates are about equal half-way, will people want to maintain two exchanges in any town? If the Bell local exchange is not driven out, will it stay, and stay on top? There can be no question as to the widespread enlistment, in the Middle and Western states, of public opinion in favor of the independent exchanges. But if the Bell system is obliterated and only one other remains, what is the nature of the change that will hold such public sentiment together, as against "monopoly?"

Going on all around in every part of the country is seen the consolidation of local lighting interests and the rolling together of local traction interests into one system in each community. We must confess that to us this seems natural and inevitable. In lighting, it means cheaper current; in traction, it means a transfer system which saves the public many a nickel. Is the telephone business to prove an exception to this apparently universal electrical tendency? We are not prepared to answer that question ourselves, but its answer appears to involve three solutions. The independent system may sweep the Bell system away, and be itself the "monopoly." The Bell system may absorb all that is best and worth while in the independent system, and remain "on top" as at present. Or, finally, in every place of any size, a man will need two telephones because there are two competing telephone exchanges.

It is to be noted that the convention devoted itself largely to practical and financial questions, and did not venture far on the discussion of the technique of the telephonic art. Yet it seems to us that if it live and grow as it now gives such vigorous signs of doing, it might well take up the standardization of apparatus. At the present moment, the extension of toll line work is its main theme, but nothing stands in the way of successful long distance work as the use of apparatus of a heterogeneous, unstandardized character.

THE DETERMINATION OF THE WAVE FORM OF ALTERNATING CURRENTS.

The first attempt to plot the form of an alternating current or electromotive force wave was made by Joubert, who made instantaneous closures of the circuit through the measuring instruments at various parts of the cycle by means of a contact carried by the rotating part of the generating machine. The development along this line in this country early took the form of a null method, the alternating current circuit being closed for a brief instant in series with a measurable direct electromotive force, which could be adjusted to balance the instantaneous alternating electromotive force, the balance being determined by means of a sensitive galvanometer or telephone. This was improved by Dr. Louis Duncan, who used a galvanometer on the dynamometer principle, the fixed coil carrying the alternating current constantly, the movable coil getting every cycle a very brief impulse of direct current through the contact on the generator, the adjustment of which contact determined the part of the wave to be measured. The galvanometer was made sluggish by means of a vane working in glycerine so that the deflection measured the instantaneous value of the alternating current at that portion of the cycle when the circuit of the movable coil was closed by the contact. The chief difficulty with this apparatus lay in obtaining contacts of a perfectly regularly recurring duration.

Prof. H. J. Ryan presented before the recent meeting of the American Institute at Boston, under the utterly irrelevant title "Polyphase Electric Testing," a method for obtaining a brief electromotive impulse at a given phase relation with the alternating wave without the use of any contacts whatever. The method consists primarily in the use of a transformer having a contracted core excited by a primary voltage and number of turns sufficient to oversaturate the core at all times except just at the instant when the primary alternating current is passing through zero. The flux in such a core whips suddenly from saturation in one direction to saturation in the other at the instant when the primary current reverses, and is subjected during the rest of the time to a comparatively small and almost sinusoidal change as the increasing and diminishing magnetomotive force crowds in or lets out a few lines above saturation. The secondary electromotive force consists of a sudden jump at the instant of reversal and a comparatively very weak, almost sinusoidal, electromotive force during the rest of the time. In the instrument which Prof. Ryan described, the sudden jump amounted to 3¼ volts during 1 per cent. of the time of a primary alternation, while the virtual value of the residual electromotive force was only about 1 per cent. of this pressure. A very ingenious method of balancing out this residual wave was described. An almost instantaneous throb of current is thus obtained with a definite phase relation to the alternating current supply, which phase relation can be readily adjusted by means of phase changing transformers, or, as in Prof. Ryan's own experiment, by taking the exciting current of his peculiar transformer from the secondary winding of a polyphase induction motor, which secondary was prevented from rotating and was moved through slight angles to adjust the phase relation. The whole plan was aptly characterized in the discussion by Mr. Chas. P. Steinmetz as "artistic."

The means of determining wave forms and thereby the number and relative strength of the harmonics, which are of considerable importance in certain lines of alternating current work, are rapidly improving in at least two widely different directions. The plotting of the instantaneous values determined by a series of readings—which the above mentioned instrument assists—requires absolutely the constancy of several conditions, notably speed and load, while the series of readings is being taken, a requirement always difficult to comply with and impossible in the case of rapidly changing functions, such as those of the alternating current arc, etc. The oscillograph of M. Blondel gives a graphic representation of every wave, following rapidly the variations of the conditions in a most remarkable and beautiful manner, which is, however, unrecorded unless the instrument is worked with a sensitive photographic film, as has been done by Prof. H. J. Hotchkiss.

THE INSTITUTE PAPERS.

The general meeting last week in Boston of the American Institute of Electrical Engineers was entirely satisfactory both with respect to the character of papers read and the discussions which took place. It is true that the attendance was not proportionately as large as at the annual meetings of some of the older engineering organizations, but it was representative in character, including leaders in every branch of the profession. The attendance on the annual meeting of their professional bodies appears to be a habit on the part of the leading members of other engineering societies, and in time this will probably be true with respect to the American Institute of Electrical Engineers. Aside from esprit du corps, or perhaps we might say the duty which engineers owe to their profession, there are other considerations which tend toward this condition, not the least being the opportunity afforded of enjoying a semi-vacation, and of enabling touch to be kept with the profession in a manner as agreeable as experience has shown it to be profitable materially.

Of the eleven papers read, three may be classed as original contributions to electrical science—those of Messrs. Steinmetz, Ryan and Goldsborough. The paper of Mr. Steinmetz is of direct practical value for the reason that it extends his system of analysis to phenomena heretofore so extremely difficult of treatment by the usual analytical methods as to lead to their neglect in engineering calculations. It was shown that the equivalent sine curve is not a safe assumption in certain cases, as neglect of harmonics which such assumption involves may lead to erroneous deductions with respect to the angle of lag and the output. The paper also brings out the influence of harmonics on condenser action, thus explaining a number of supposed anomalies. The paper by Prof. Ryan lays down a beautiful and comparatively simple method for determining the form of variation of alternating current and pressure, which has a practical value in view of the fact that the very strict requirements now demanded by purchasers with respect to the performance of alternating-current machinery, bring the matter of such determination into the field of design. The paper of Prof. Goldsborough treats of a point in machine design which, though of minor importance practically, is none the less of technical interest.

Of more purely engineering interest are the papers of Messrs. Garratt, Moses, Sever and Fliess, and Sperry. The first-mentioned has, in fact, the chaarcter of a monograph on the subject of the design of water-power plants for electrical generation, all the various principles in the hydraulic design having a bearing on speed regulation being fully considered. As quick regulation is of prime importance, the paper dwells upon the subject of the inertia factor and brings out more prominently than is usual in hydraulic treatises the influence on this factor of the length and inclination of the flume. The paper by Messrs. Sever and Fliess (appearing in full abstract elsewhere in this issue) gives the most valuable collection of data yet made concerning the cost of parcel delivery service by horses and electric automobiles, the first-mentioned data being of particular interest at this juncture. The paper by Mr. Moses is also a useful contribution to engineering data, giving very complete figures as to the cost of isolated electrical installations in specified office buildings. It may be added, however, that as the paper is frankly *ex parte* in character,

the conclusions drawn from these data cannot be accepted as general in their bearing. The paper by Mr. Sperry deals with some of the constructional factors in automobiles, and is thus an admirable supplement to that of Messrs. Sever and Fliess.

The paper by Dr. Hutchinson on the protection of secondary circuits from fire risk has an important consequence, as it led to the adoption of a resolution committing the Institute as a body to the advisability of grounding one side of low-tension consumption circuits, the adoption of which resolution was supported at the meeting by two of the leading Underwriters' experts of the United States—Capt. Brophy and Mr. C. M. Goddard. The paper by Mr. Doane, entitled "A Plea for a Working Standard of Light," may also lead to action by the Institute, having for an object the provision of means for supplying secondary standards to those interested in photometric measurements of incandescent lamps. The National Electric Light Association several years ago appointed a committee on the subject, but thus far there has been no result. The importance of the matter at issue requires that something should be done, and it is hoped that the Institute will again interest itself, this time with a view to bringing this matter to a definite conclusion. The paper by Mr. Adams is useful in bringing out what little attention has been paid with respect to variable speed in the case of the direct-current motor. The problem of a number of efficient speeds for this type of motor is by no means a difficult one and, as pointed out, a number of entirely commercial solutions are at hand waiting for application. The paper by Prof. J. P. Jackson gives a resume of the present state of the application of electricity to coal mining, and as it is based upon studies and comparisons of plants in the great coal regions of Pennsylvania and adjoining states, the information contained has a most direct bearing.

PRACTICAL LAMP STANDARDS.

Mr. Doane's paper read at the recent general meeting of the American Institute of Electrical Engineers calls attention to the pressing necessity which exists at the present time for a practical standard of light. In spite of the millions of incandescent lamps that are in daily use, and in spite of the fact that the art and science of photometry antedate the electric telegraph, telephone and modern electrical engineering, yet there is of necessity a great divergence in the measurements which are made by different observers in practical photometry, for the reason that the personal equation enters more largely into this class of observation than in almost any other of the so-called exact sciences. It is possible for careful observers to agree closely upon the measurement of a uniform luminous source in terms of a standard uniform luminous source, when using a good photometer, and when the colors of the two luminous sources compared are approximately the same, as, for example, when an incandescent lamp is measured in terms of a standard incandescent lamp. But it is not possible in the existing state of science to compare the luminous intensities of two luminous sources that are of markedly different colors, for the reason that the physiological effects of different colors upon the eye are matters of personal estimate, and are not susceptible of measurement. Thus, it is not possible to measure the candle power of an incandescent lamp in terms of an amylacetate lamp with any high degree of precision, no matter how good the photometer or how careful the observer, owing to the redness of the amylacetate standard light as compared with the color of an ordinary incandescent lamp filament.

Theoretically then, the only proper luminous standard for the measurement of incandescent lamps is a lamp having exactly the same mixture of colors as the lamp to be measured, and this means, in practice, that a standard incandescent lamp is the only proper standard for measuring the candle power of incandescent lamps It is not possible, however, to prepare an incandescent lamp which shall be reproducible at all times and in all parts of the world as having a certain luminous intensity under a given difference of potential applied at its terminals. Even if the filaments could be gauged with the necessary degree of accuracy, the vacuum adjusted to the corresponding degree, and the resistance of the filament under given conditions exactly assigned, the difference in the surfaces of different filaments would prohibit their exhibiting uniform luminous intensities under similar electric conditions. Consequently, a primary incandescent lamp standard is at present out of the question. A variety of luminous standards exist at the present time, from the Violle square centimetre of molten platinum to the so-called standard candle. They exhibit great differences, but resemble each other only in the fact of their general unsatisfactoriness. The Violle standard comes the closest to being a scientific standard, but is very troublesome to use under practical conditions. The least unsatisfactory standard produced up to the present time, that has been subjected to long and careful observation, is the amylacetate lamp. This has a burner of definite dimensions which consumes a chemically pure hydrocarbon. Reports upon the behavior of this standard from England, from Germany and from the United States, are generally in accordance upon the uniformity of this standard. It is the standard which has been provisionally recommended by the Committee on Units and Standards of the American Institute of Electrical Engineers.

What is wanted, therefore, is the measurement of half a dozen standard incandescent lamps in terms of the amylacetate standard lamp, and through this reduced to the so-called standard British candle by computation. These secondary standard incandescent lamps should be measured by the same observer or group of observers and agreed upon. They should be lamps selected with great care, and should be subjected to a preliminary operation at normal pressure for a period of say 50 or 100 hours, so as to bring them to as nearly a uniform condition of luminosity as possible, and they should be measured and operated as standards at a predetermined moderately low emissivity. From these few secondary standards operating under standard conditions, a large number of practical and commercial secondary standard incandescent lamps should be prepared, say five hundred, sufficient in fact to supply half a dozen to each and all of the various lamp manufacturers and users whose business it is to measure candle-power. These commercial standard lamps should be marked with the pressure in volts at which they give a certainly standard number of computed British candles, and these would be used as working standards from which to obtain tertiary local standards by various lamp manufacturers.

Working in this way, it should be entirely possible for five hundred incandescent standard lamps to be supplied to the electrical community, with an average difference or probable error not exceeding a sixth of a candle in a 16-candle power lamp, or, about 1 per cent., which is far closer than can be obtained to-day, when comparing different sources of light. We believe that if standard lamps were to be obtained from any two different photometers or technical laboratories to-day, it would be quite likely that the standards would disagree in the same photometer by more than 5 per cent., owing to the personal equation error in comparing with the original fundamental standards. It is to be hoped that some such procedure as that above indicated may be followed by those bodies who will have charge of the matter of issuing commercial standards. If the American Institute of Electrical Engineers takes the matter up in accordance with its resolution in Boston, we may expect to see the work carried out in a systematic and thorough manner. It is certainly much needed.

Electrical Standardization—I.

At the recent Boston meeting of the American Institute of Electrical Engineers the report of the Institute Committee on standardization of Generators, Motors and Transformers was unanimously adopted. The subject of standard rules for the benefit of engineers writing specifications and making tests was brought before the Institute several years ago by Mr. H. A. Foster. At the January, 1898, meeting of the Institute, held simultaneously in New York and Chicago, a topical discussion was held on "The Standardization of Generators, Motors and Transformers" and the matter of the appointment of a committee to report on the subject was broached. The same month Mr. S. Dana Greene, in a paper read before the New York Electrical Society, advocated the appointment of a committee by the Institute for the purpose of formulating standard requirements for electrical machinery under the heads of efficiency, heating, regulation, sparking and insulation. At a meeting of the Council of the Institute on March 23, 1898, a committee was appointed to study the subject of standardization, consisting of Professors Crocker and Thomson and Messrs. Cary T. Hutchinson, A. E. Kennelly, J. W. Lieb, Jr., Charles P. Steinmetz and L. B. Stillwell. The final report of this committee was that adopted at Boston. The report includes a classification of apparatus, and heads as follows:

Efficiency, which is treated under the sub-heads of commutating machines, synchronous machines, synchronous commutating machines, rectifying machines, stationary induction apparatus, rotary induction apparatus and transmission lines. The other heads are Rise of Temperature, Insulation, Regulation, Variation and Pulsation, Rating, Classification of Voltages and Frequencies and Transmission Lines. An appendix contains notes on efficiency, apparent efficiency, power factor and inductance factor, rotation and a table of sparking distances.

CLASSIFICATION OF APPARATUS.

I. *Commutating Machines,* which comprise a constant magnetic field, a closed-coil armature and a multi-segmental commutator connected thereto. Under this head may be classed the following: Direct-current generators; direct-current motors; direct-current boosters; motor-generators; dynamotors; converters and closed-coil arc machines. (See III.)

A booster is a machine inserted in series in a circuit to change its voltage, and may be driven either by an electric motor, or otherwise. In the former case it is a motor-booster. A motor-generator is a transforming device combining both motor and generator action in one magnetic field, with two armatures or with an armature having two separate windings.

II. *Synchronous Machines,* which comprise a constant magnetic field, and an armature receiving or delivering alternating currents in synchronism with the motion of the machine; i. e., having a frequency equal to the product of the number of pairs of poles and the speed of the machine in revolutions per second.

III. *Synchronous Commutating Machines.*—These include: 1. Synchronous converters; i. e., converters from alternating to direct, or from direct to alternating current, and 2. Double current generators; i. e., generators producing both direct and alternating currents.

A converter is a rotary device transforming electric energy from one form into another without passing it through the intermediary form of mechanical energy. A converter may be either: a. A direct-current converter, converting from a direct current to a direct current; or b. A synchronous converter, formerly called a rotary converter, converting from an alternating to a direct current, or vice versa.

Phase converters are converters from an alternating-current system to an alternating-current system of the same frequency but different phase. Frequency converters are converters from an alternating-current system of one frequency to an alternating-current system of another frequency, with or without changes of phase.

IV. *Rectifying Machines, or Pulsating-Current Generators,* which produce a undirectional current of periodically varying strength.

V. *Stationary Induction Apparatus,* i. e., stationary apparatus changing electric energy from one form into another, without passing it through an intermediary form of energy. These comprise:

a. Transformers, or stationary induction apparatus in which the primary and secondary windings are electrically insulated from each other.

b. Auto-transformers, formerly called compensators; i. e., stationary induction apparatus in which part of the primary winding is used as a secondary winding; or conversely.

c. Potential regulators, or stationary induction apparatus having a coil in shunt, and a coil in series with the circuit, so arranged that the ratio of transformation between them is variable at will. These may be divided into:

1. Compensator potential regulators, in which the number of turns of one of the coils is changed.

2. Induction potential-regulators, in which the relative positions of primary and secondary coils is changed.

3. Magneto potential-regulators, in which the direction of the magnetic flux with respect to the coils is changed.

d. Reactive coils, or reactance coils, formerly called choking coils; i. e., stationary induction apparatus used to produce impedance or phase displacement.

VI. *Rotary Induction Apparatus,* which consist of primary and secondary windings rotating with respect to each other. They comprise:

a. Induction motors. b. Induction generators. c. Frequency changers. d. Rotary phase converters.

The various heads of the report will be taken up in succession.

Meeting of the Canadian Electrical Association.

The Canadian Electrical Association held its ninth annual convention in the convention hall of the New Royal Hotel, Hamilton, Ont., on Wednesday, Thursday and Friday, June 28, 29 and 30, commencing at 2 o'clock p. m. on Wednesday. There was a very large number of members in attendance and great interest was shown in the papers read, which were teeming with matter for discussion. The president, Mr. W. H. Browne, manager of the Royal Electric Company of Montreal, Que., occupied the chair.

The annual banquet was a great success and was attended by one hundred members and guests. The election of officers took place on Friday morning, resulting as follows: Mr. A. A. Dion, Ottawa, president; Mr. E. E. Cary, St. Catharines, first vice-president; Mr. P. G. Gossler, Montreal, second vice-president. Executive Committee: Five members re-elected, J. J. Wright, Toronto; A. B. Smith, Toronto; O. Higman, Ottawa; George Black, Hamilton, and John Carroll, Montreal. Five new members elected: Mr. Street, Ottawa; W. H. Browne, Montreal; A. Sangster, Sherbrooke; R. H. F. Wyse, Brantford, and B. F. Reesor, Lindsay.

The local committee, consisting amongst others of Messrs. E. E. Cary, St. Catharines; Mark B. Thomas, H. R. Leyden, George Black, C. K. Green, A. J. Nelles, George J. Henderson, of Hamilton, and A. B. Smith, of Toronto, had arranged for a number of pleasant social features and did all that was possible to make the convention a success.

A Pacific Cable Discussion.

According to a London despatch on June 29, the Secretary of State of the Colonies, Joseph Chamberlain, and the Chancellor of the Exchequer, Sir Michael Hicks-Beach, received a deputation for the Eastern Telegraph Company. The Marquis of Tweeddale and others expressed objection to State competition with private enterprise, referring to the proposed Pacific cable, and Sir Michael Hicks-Beach promised to furnish a written reply. In the meantime he reminded the deputation that the Pacific cable project was not new, and was one the Government had a perfect right to undertake. Mr. Chamberlain said that, while customers justly complained of the existing high rates, it was mainly for the sake of an "all-British" cable, connecting all portions of the empire, that the Government entertained the present project. The Marquis of Tweeddale declared the proposed cable would easily lead to the ruin of the cable companies the delegation represented, and advanced the alternative plan of providing for the formation of a British imperial telegraph company to take over the securities of the present companies, the stock of the new company being guaranteed by the Government at 2½ per cent. interest, the present large reserve fund of the companies being used to lay the Pacific and other cables, and the surplus revenue from the reduction of interest to be devoted to reducing rates and relieving the capital. Sir Michael Hicks-Beach said that the best answer to the Marquis of Tweeddale's alternative proposal was that neither India nor Australia was prepared to support it.

The Generating Plant, Distributing System and Transportation Facilities of the Highest Office Building in the World.—II.

ELEVATORS.

BY far the most difficult problem which presented itself and demanded solution was the provision for rapid and safe transit of the 4000 inhabitants of this vertical town. Most of these arrive between the hours of 8 and 10 a. m., they rush out for luncheon, and return between the hours of 12 and 2; and they finally leave for the night between 4:30 and 6 p. m. Add to their number the thousands of people who pass in and out all day on business, and it will be seen that the transit or elevator problem of this great office building is fairly comparable to handling the surface traffic of a good-sized and enterprising city.

The limited space available, the great height of lift, the need of flexibility and considerations of economy of operation, finally resulted in the award of the contract for the entire elevator equipment to the Sprague Electric Company, of New York City.

The full contract included 15 elevators of all sizes. The machines of most interest, however, are the ten passenger elevators, and one slow speed drum elevator for safes, running from the ground floor to the 25th and 26th stories. Fig. 9 gives a first floor plan of the building and affords an idea of the location of all of the elevators. The main passenger cars are seen grouped about in a semi-circle in the centre of the building, nine in the arc and ten in a separate shaft at the side nearest the Park Row entrance. Five of these elevators rise to the 25th floor, a height of 297 feet, and five rise to the 26th floor, with a vertical lift of 308⅔ feet. One, intended for safes and heavy freight, runs from the sub-basement to the 25th floor, a lift of 423 feet 7 inches. The hoisting machinery and counterweights for these elevators are placed in the two triangular spaces behind the elevator shafts. Five machines are placed in each space, as shown in Fig. 10. A floor is placed under the motors for convenience in examining and cleaning the commutators and other parts, which are seen in Fig. 11. Below this in two well-protected rooms are placed the switchboards, each made up of five controlling panels.

As the elevators are alike in all particulars, a description of the details of one will suffice for all. Fig. 12 shows diagrammatically the principle of the elevator operating machinery, and the method of "roping up." Each elevator equipment is complete in itself, and consists of an electric motor with a vertical armature standing 8½ feet high from the bottom of the armature thrust bearing to the top of the frame; a vertical screw of special design, about 22¾ feet long; a set of traveling sheaves attached to a nut running on this screw; a corresponding set of fixed sheaves suspended part way up the shaft; a moving counterweight; a pair of counterbalance chains attached to the counterweight, and suitable overhead deflecting sheaves. These are shown diagrammatically in Fig. 12 and to scale in Fig. 13. For a full understanding it is best to start with the car cables, where they are attached to the car frame. These are ⅝-inch steel cables, 6 in number, and it will be noticed that they pass up and over the deflecting sheaves at the head of the shaft, and down under the sheaves of the multiplying counterweight, and again up to the framing overhead, to which they are attached. To the bottom of this counterweight, called the moving or traveling counterweight, are attached the four working cables. These are ¾-inch in diameter, and wrap back and forth about the fixed and traveling multiplying sheaves, finally anchoring to the frame of the fixed sheaves. This part of the apparatus may be compared to a block and fall, the end of the rope being fastened to the counterweight, and the screw, to be described later, attached to the block. In Fig. 12 only one pair of operating cables is shown, but in the elevators, as installed, another pair wrap in the opposite direction to balance the strains. This arrangement multiplies any movement of the nut 16 times, and increases the car speed in like ratio. To the bottom of the counterweights are attached two heavy balancing chains made of 1⅜-inch round iron with 6-inch links. The purpose of these chains is to balance that portion of the car cables hanging over the overhead deflecting sheaves into the shaft. Examining Fig. 12 it will be apparent that when the car is descending the total weight of cable hanging in the shaft is increasing, and, conversely, when the car ascends the cable weight is constantly decreasing. This introduces a variable load upon the entire equipment which would affect the speed of the car and otherwise interfere with the best operation of the equipment were some means not adopted to equalize or balance the weight of the cable. In the majority of elevator systems, where there is a considerable lift, this is compensated for by attaching one end of a chain or chains directly to the bottom of the car and anchoring the other end midway up the shaft. With this arrangement the weight of the chain is added link by link as the cable shortens, or removed link by link in the same way as the length of the hanging cable increases with the descent of the car. With the elevators under consideration, the chain is attached to the moving counterweight, and, therefore, has only half the length which would be necessary were the other systems employed.

As the mechanical details of this interesting machine have frequently been described in these columns, we will omit any further mention of them here and give the important electrical features and method of control.

The motors are 4-pole machines, with two salient and two consequent poles; that is, field coils are used on only two of them. The yoke is of steel, cast to form part of the elevator framing. The armature is of the usual iron-clad, two-path series winding type, using carbon brushes. The field coils have two windings, a series and a shunt, the latter is connected to the car, and is under the control of the car operator.

The armature shaft is securely keyed to the operating screw, and as it is thus always in tension, a substantial thrust bearing is necessary. This bearing is placed at the very bottom of the motor, as shown in Fig. 11, and is of a unique design. The armature shaft slips through an ordinary cylindrical sleeve bearing, 6 inches long, through two hardened and ground steel washers, and has a heavy nut screwed up against a thick steel bearing washer. Between the two hardened washers is placed a bronze plate, which has a series of rectangular perforations, just wide and long enough to admit small hardened steel cylindrical rollers. These perforations are arranged spirally, so that the entire surface of the bearing plates is rolled over. Just below this bearing is another, but smaller, thrust bearing, whose purpose is to support the weight of the armature shaft and screw at such times as the load is removed from the nut. The whole lower bearing, including the roller and end thrust bearing, is surrounded by a cast-iron protecting casing, which also serves as an oil cup, and permits the bearing to be flooded at all times with oil, thus insuring cool and free running.

The method of control, commonly known as the Sprague pilot motor control, is extremely simple, and depends upon a small hand switch in the car, conveniently placed for the operator. This switch is connected by means of a flexible cable containing six wires, with the operating switchboard in the basement of the building. Each car has one panel of the switchboard, to which the current supply feeders, leading from the generating plant, and the six conductors of the flexible cable are attached. Two of these wires are for the car lights, one for the car switch, one for up, one for down, and one for stop. Upon the upper portion of each of these panels, Fig. 14, is bolted a heavy bracket, which supports the "pilot motor," its brake and the contact arm of the starting resistance. Below this are four solenoid magnetic switches, which are called, beginning at the left hand of Fig. 14, the throttle, electric governor switch, the stop relay and the brake release. Below these are the three automatic main switches known as the auxiliary circuit breaker. It is impossible in this article to describe fully the operation of these switches, all of which are controlled either directly or indirectly from the car. Fig. 15 is a diagram of a complete panel for one elevator, showing the method of connecting up the motor, switches, etc., from the feeder taps to the cable which leads up to the car-controlling switch. This looks somewhat complicated; but if it is examined along with Fig. 14, bearing in mind at the same time that practically all these connections are solidly made at the factory, the system will be seen to be as it is in reality, very simple.

To explain the operation of the automatic part of these elevators, consider one car, since all are alike, and assume that the operator shifts the handle of the switch in the car to the "up" position. This operates the magnetic switches, Fig. 14, and throws the line current into the armature of the main motor, through sufficient resistance to just hold the armature. At the same time the brakes of the main and pilot motor are released and the armature of the pilot motor begins to revolve. On the end of its shaft is a worm which meshes into a worm wheel on the spindle of the rheostat arm. The revolution of the pilot armature gradually sweeps this arm around the contact circle, Fig. 16, and cuts out the armature resistance,

*See Supplement for illustrations to which references are made.

thus increasing the speed and torque of the armature of the main motor. The time occupied in this starting can, within certain limits, be controlled by the operator; in other words, he may start as slowly as he pleases, but can never start faster than a certain predetermined safe rate.

To stop the car the operator simply lets go of the switch handle and instantly the main motor current is cut off, the springs throw the brake into action, and the rheostat arm slowly revolves back to the off position. Should the operator be crowded away from the controller, become careless or frightened, and let go of the switch handle, the car stops automatically and instantly.

When the car descends the armature of the main motor is first short-circuited, and then the resistance is gradually cut into the armature circuit by the pilot motor, increasing the speed of the car. As it approaches the bottom of the shaft, connection is made between the motor and an independent circuit known as the "retarding circuit" and the resistance in the armature circuit is gradually reduced, bringing the car quickly and yet smoothly to rest.

Aside from the safety features of the nut, already described, other safeguards are employed. The most important of these are the safety catches placed under the car and rigidly attached to the heavy framing. These are simply lever jaws arranged to clamp the steel car guide-rails when the long arms of the levers are forced apart by wedges driven between them by powerful springs. They are operated by a centrifugal trip governor placed on the car. This governor consists of a small grooved wheel, which is revolved by a rope extending from top to bottom of the shaft where it is fastened. On this wheel are two pawls, normally held against stops by a spring, but which fly out when the adjusted speed is exceeded and trip the safety catches. There are also two "limit stops" mounted on the motor frame and arranged to be tripped by suitable triggers on the moving crosshead. These are designed to prevent the possibility of the motor overrunning and jamming the car against the top or bottom of the shaft.

In addition to the passenger elevators there are the following smaller or special elevators:

Two tower elevators, type "V"—Capacity, 2,000 lbs. live load; h. p. for lifting maximum load, 25; probable average h. p. under service, 6, at a speed of 180 feet per minute.

Two dumb waiters, in towers, type "T"—Capacity, 200 lbs.; h. p. for lifting maximum load, 10; probable average h. p. under service, 5, at a speed of 120 feet per minute.

One sidewalk elevator, type "Y"—Capacity, 2,500 lbs.; h. p. for lifting maximum load, 8; probable average h. p. under service, 4, at a speed of 50 feet per minute.

One sidewalk elevator, type "Q'.'—Capacity, 8,000 lbs.; h. p. for lifting maximum load, 25; probable h. p. under service, 12, at a speed of 50 feet per minute.

Safe hoist, type "W."—Capacity, 8,000 lbs.; h. p. for lifting maximum load, 25, at a speed of 50 feet per minute.

The 8,000-pound sidewalk elevator has a number of interesting features. The safe hoist elevator, as already mentioned, runs in the same shaft with one of the regular passenger elevators. It is supported by two ⅞-inch steel cables and employs a standard drum machine with two 44-inch drums, using the double Hindley worm, wormwheels, etc. The single motor is controlled only by a rheostat in the basement, placed near the winding machinery to avoid any chance of collision with the passenger elevator, in whose shaft the safe hoist runs.

Regarding the efficiency and cost of operating the passenger elevators no absolute data can be given, as no tests have as yet been made. It is quite certain, however, that the average running current for the average live load in the car will not exceed 175 amperes at 120 volts. This current is used in hoisting only; none is used while the car is descending, so that the average current per trip will be one-half of the above. The kilowatt hours per car mile are expected not to exceed 3½.

SWITCHBOARD.

The switchboard, shown in Figs. 16, 17 and 18, was designed and built by the Westinghouse Electric and Manufacturing Company from specifications by the electrical engineer. It is in many respects unique, not only in the completeness of the appliances and the facilities which it affords for controlling the operation of the generating plant, but in the thoroughness of the engineering work and workmanship bestowed upon it by the contractor. It is arranged to control the output of the four 125-volt generators, also for one motor-driven and of one steam-driven booster, and the current from the storage battery. The switchboard has three main divisions. The center panel serves for the electrical manipulation of all circuits from the main dynamos, booster dynamos, and the storage battery, constituting the electrical generating plant. The right panel serves for lighting feeders only. The left panel serves for power feeders only. The three panels are side by side, forming one continuous switchboard.

Each generator is provided in its negative circuit with a single pole—fused switch—circuit breaker, an ammeter, while the positive and equalizer circuits pass through a double pole switch, the positive circuit only being fused. One of the 200 kilowatt and the 100 kilowatt Westinghouse generators are connected to run in multiple, on a separate section of bus bars at the left end of the dynamo panel facing the front, while the other 200 kilowatt generator runs in multiple with the 75 kilowatt on a similar section of bus bars at the right hand end. The boosters, booster motor and storage battery are connected through their switches to the central section of bus bars. This central section may be thrown in multiple with either or both of the end dynamo sections by means of the heavy three-pole bus-junction switches. If these are left open, the right and left sections of the dynamo panel will be entirely disconnected from the middle section, and the units corresponding to said panels will operate as if they belonged to distinct generating stations, one serving for the lighting current supply, and the other for the power current supply. By closing the left "bus-junction" switch, the storage battery plant may be coupled, so to speak, to the power side. By closing the right switch, it may be coupled to the lighting side, and lastly, by closing both switches, the two power plants become coupled together into one single generating plant, including the storage battery. This may also be thrown on the bus bars independently, and the whole generating plant shut down in case of light load, the battery supplying all the necessary current. These features of the center or generating panel of the switchboard are similar to those on the large switchboard in the Astoria Hotel, also designed by Mr. Mailloux and described in THE ELECTRICAL WORLD of December 25, 1897.

The power and lighting sections are each provided with an ammeter, a recording wattmeter, and a recording ammeter for measuring the total current. The lighting section has provisions for 48 feeders, 16 of these being 100 amperes and 32 being 200 amperes capacity. They are all provided with double pole fused switches, and 16 of the 200 ampere circuits have circuit breakers in addition. The power section provides for ten 300 ampere and ten 500 ampere circuits, each circuit being supplied with a fused switch and a circuit breaker.

The current from the storage battery is measured by a double reading ammeter, a double reading recording ammeter, and a recording wattmeter, this circuit being also provided with a 3000 ampere switch and circuit breaker.

The dynamo panel carries a ground detector, a recording voltmeter, a differential galvanometer, and a main station voltmeter; the galvanometer, ground detector and station voltmeter each being provided with suitable multipoint switches for connections to the various circuits. There are also ammeters for each booster circuit, and switches for manipulating the boosters, and starting the booster motor. All the rheostats are operated by hand-wheels placed on the front of the board.

The board is constructed of the best Tennessee marble of uniform coloring, the separate slabs being joined together by accurately squared edges, presenting the appearance of three large panels. A rigid angle and channel iron frame supports the entire board, the whole being carried on iron pedestals, which raise it six inches above the floor. The total length is 42 feet.

The power section at the left end of the board is provided with a marble door, in order that the rear of the board may be conveniently reached from the engine room. The length of the power section is 12 feet, and the height 8 feet above the floor. The length of the dynamo section is 16 feet and the height 9 feet 3 inches. The length of the lighting section is 14 feet, and the height 9 feet 3 inches. An ornamental moulding of bright copper frames each section, and all the instruments, hand wheels, double goose necks, instrument cases, and metal trimmings are finished in bright copper. A neat grill work fills the space between the switchboard and ceiling, and hides the pedestals below the board.

Copper-finished engraved name plates are provided for all instruments and switches, to designate the circuit each operates. All

the bus bars and rear connections of the rear of the board are made of the best lake copper, the connections being secured to instrument studs by means of heavy copper nuts screwed on the studs. On account of the complicated nature of the connections the rear of the board presents a perfect network of copper, but the parts are well supported. The individual bars are carefully spaced and symmetrically arranged, and present a very neat appearance, the whole being an excellent piece of switchboard engineering. Indeed to the careful, visiting engineer, the front of the switchboard, handsome as it is, is not as attractive or interesting as the constructive details at the rear of it.

The cables for the dynamo leads pass from the board directly into conduits. The feeders for lighting and power rise from the rear of the feeder panels to the ceiling of the dynamo room in conduits. Every part of the board is designed to carry its rated current without appreciable rise in temperature above the surrounding air. The circuit breakers are of a new and novel design, having laminated copper blades, closed with a toggle joint. They break the circuit at the carbon shunts supplied at the top. All the switches are of the unit blade variety. A single unit blade of definite capacity is used. One or more blades are combined in multiple to make up switches of the required capacity. All switches are built of the best lake copper, no castings being used in their construction.

The switches and circuit breakers are finished by hand with a good tool finish. The main bus junction switches are of the screw press type, and are 3-pole in order to connect together the positive, negative and equalizer sections of the bus bars. They are constructed on the unit blade principle, each blade being composed of three 1000 ampere units in multiple, each with its independent set of jaws. The blades move in and out of their jaws by turning a crank handle attached to the hand wheel, and are kept in proper alignment by suitable guides. The capacity of each of these switches is 3000 amperes.

The shunt resistances for varying the compounding of the boosters are constructed of grids of special resistance metal. They are supported on the rear of the board, near the top, and are suitably connected to the various switches by hard rolled copper bars.

All ammeters and voltmeters are of the Weston type with the exception of the registering meters, which were supplied by Chauvin & Arnoux, of Paris, and are also of the permanent magnet type, but have a registering device attached. These meters were fully described in *L'Industrie Electrique*, March 25, 1897.

SYSTEM OF DISTRIBUTION OF LIGHT AND POWER.

Let us imagine the entire network of conductors supplying a town of 4000 inhabitants, or 950 separate dwellings, with current, placed on end, and we have an aproximate idea of the system of conductors in this immense building and the problem which presented itself for solution. From the immense switchboard, which has just been described and which, in completeness, has never been equaled, 57 main arteries, called feeders, branch out in various directions, 27 to supply current for general lighting, 13 for hall lighting and 17 for power purposes. These feeders run direct to certain floors and are prolonged by mains and submains to floors immediately above and below. For lighting purposes the various floors may be considered as subdivided into various sets of floors, each set having its own feeder system. Each floor is fed in sections by feeders, which also supply the corresponding sections of the floors above and below of the same "set" through mains and submains. In each case the middle set of the "set" is the "feeder floor," or the floor at which the feeders coming direct from the main switchboard terminals, and at which the mains for the floors above and below, originate. Each individual floor is subdivided into various sections, each of which corresponds to an electrical distributing centre, serving as the feeding point for the branch circuits in such sections. For the general branch circuits for general lighting there are five such centres at all floors from the second to the twenty-fifth, including four at the first floor and at the basement, three on the twenty-seventh floor, two at the sub-basement, and at the twenty-ninth, thirtieth and thirty-first (tower stories) and none on the twenty-eighth and thirty-second stories. For hall lighting there is one distributing centre at the second and twenty-sixth floors and three on all floors from the third to the twenty-fifth inclusive.

There is a total of 7518 lights in the building and 4498 outlets. Besides these current is supplied to the following motors:

Ten for passenger elevators, one for freight elevator, two for lifts, three for ventilating fans, one for fan (26th floor), one for electric pump, one for refrigerating machine, two for passenger elevators (30th floor), two for dumb waiters.

There are in all seven sets of leads to or from the centre or generating panel as follows:

		Average length in feet one way.	Size in C. M.
1 Dynamo, No. 1, 100-kw		25	1,200,000
2 Dynamos, No. 2, 75-kw		20	800,000
3 Dynamos, No. 3, 200-kw		43	4,000,000
4 Dynamos, No. 4, 200-kw		46	5,000,000
5 Steam booster, 40	Series	50	3,000,000
	Arm	44	3,000,000
6 Motor booster, 20	Series	33	1,500,000
	Arm	37	1,500,000
	Motor	37	400,000
7 Storage battery		43	3,000,000

Summing up there are:

40 light feeders, 17 power feeders, 255 lighting mains, 10 power mains, 1409 branch circuits, 4498 outlets, 7518 lights, 299 cut-outs, 144 centres of distribution, 3 D. A. switches, 137 P. B. switches, 8 knife switches, 6 switch mains. This brief summary gives one but a faint idea of the magnitude of the main wiring, which was devised by the consulting engineer and executed by the New York Electric Equipment Company.

INTERCONNECTION SYSTEM.

Beside rapid transportation facilities and abundant light during all hours of the day and night the tenants of modern office buildings demand means of communication which will annihilate the heights to which they have ascended in search of air and the distance which separates them from the lower world. There is frequently expressed a desire for telgraph and telephone service, a district messenger call box and and even a quotation ticker, and circuits to supply all of these must be run into every office in the building. Such a system of wiring, no less complicated than the main system itself, has been installed in this building and is called the interconnection, or "ready made" system. Local interconnection stations interconnect by means of trunk lines or interconnection cables with a main interconnection box, shown in Fig. 19, constituting a "central station" for the system. By means of interconnecting lines the local circuit connections with any particular intercon

FIG. 20.—TELEPHONE SWITCHBOARD.

nection box may be extended. For the bell work there have been installed: One central interconnection box, two sub-central interconnection boxes, 24 nodal interconnection boxes, 122 district and sub-district boxes. Eight sizes of cables have been used containing 10, 12, 14, 16, 20, 30, 40 and 50 wires, respectively, in pairs and twisted. Included in this system are two water tank telltale outfits.

The office telephone system serves as a general means of communication whereby the tenants can communicate with one another and with the telephone central on the first floor. Here the central operator is located and the switchboard, shown in Fig. 20, has been installed. This board was built by the Western Telephone Construction Company, Chicago, and is of the "Keelyn System" central energy type, with a capacity of 300 drops an angle in two sections of 150 drops each. It is fitted with Western special express drops, consisting of individual night alarm springs, self-restoring drop shutters and extra long heavy German silver spring jacks. The switchboard is further equipped with interconnecting plugs and calling plugs, listening-in buttons, operators' receiver with head band and the new "Keelyn A" type solid back, solid front switchboard transmitter, suspended by an adjustable nickle-plated arm. The cabinet work is of finished antique quartered oak embellished with light bronze and nickle-plated trimmings.

Taken as a whole the equipment is a very handsome piece of apparatus and reflects great credit upon the manufacturers of the same. For the operation of the telephone system, which includes 200 local station outfits, four cells of storage battery and a motor dynamo have been installed.

The following summary of the interconnection wiring shows the magnitude of this branch of electrical service in a modern office building:

Forty-four trunk cables, 20 ft. long; 156 trunk cables, 30 ft. long; 376 trunk cables, 40 ft. long; 15,954 trunk cables, 50 ft. long; 1043 interconnection boxes, branch cables, 10 ft. long; 179 interconnection boxes, branch cables, 12 ft. long; 100 interconnection boxes, branch cables, 14 ft. long; 298 interconnection boxes, branch cables, 16 ft. long; 828 interconnection boxes, branch cables, 20 ft. long; 1113 interconnection boxes, branch cables, 30 ft. long; 2233 interconnection boxes, branch cables, 40 ft. long.

Size of cables.	Min. size of conduit.
10 wires	¾ inch.
12 wires	¾ "
14 wires	1 "
16 wires	1 "
20 wires	1 "
30 wires	1½ "
40 wires	1½ "
50 wires	2 "

The problems met, as may be surmised from the foregoing descriptions, were numerous, unique and complex, and the manner in which they have been solved reflects great credit on the engineers, and on the companies furnishing and installing the machinery. Mr. R. H. Robertson, New York, was the architect of the building, and Mr. A. Pauli, of his staff, had the general charge of the plans and details. Mr. W. H. Gorham was the architect-superintendent at the site. Mr. G. W. McNulty, M. Am. Soc. C. E., was retained as consulting engineer on foundation piling work, and Mr. Nathaniel Roberts was consulting engineer of the iron construction. Mr. C. O. Mailloux prepared the specifications and plans for the complete generating plant and distributing system, and was ably assisted by Mr. Willis H. Heath, who laid out and supervised the construction of the steam plant, and by Mr. Charles E. Knox, his chief assistant, who had the general direction of the electrical construction work. The steam heating plant was supplied by E. Rutzler; elevators, Sprague Electric Elevator Company; generators, dynamos and switchboard, the Westinghouse Electric and Manufacturing Company; wiring, New York Electric Construction Company; engines, Dick, Church & Co.; boilers, Babcock & Wilcox Co.; pumps, Deane Steam Pump Company. Last but not least, it should be stated that the task, gigantic in itself, of the general management, supervision and control of all the contractors, sub-contractors, and of all business details generally, was successfully disposed of by the firm of John Downey, the well-known builders, who were the general contractors in charge of the whole enterprise, just as in the case of the Astoria Hotel and many other large buildings similarly constructed by them.

The General Meeting of the American Institute of Electrical Engineers.

THE sixteenth general meeting of the American Institute of Electrical Engineers, an account of the first day's proceedings of which appeared last week in these columns, continued its sessions on Tuesday and Wednesday, June 27 and 28. The meeting was a very satisfactory one, the attendance being representative, if not so large as at some previous general meetings. The programme was carried out as printed with the exception of a few papers read out of place, and several that were not placed in the hands of the secretary in time for presentation to the meeting. In all eleven papers were presented, with few exceptions each giving rise to a discussion that added materially to the subjects under consideration.

The courtesies received by members in attendance through the good offices of the local entertainment committee, were many and much appreciated. Prof. Puffer, Messrs. James I. Ayer, Allen V. Garratt, Everett Morse and several others of the local entertainment committee were in constant attendance, and spared no pains to render the visit of the members to Boston one to be long remembered from its social side.

As previously stated in these columns, on Monday a visit of inspection was made to the new Boston Terminal Station, after which special cars were taken to the new Boston Electric Light Station, a description of which appeared in our issue of May 27 last. On Tuesday afternoon one party made a visit to Harvard University and another to the works of the New England Gas & Coke Company. At Harvard University the members were received in the faculty room by Prof. Ira N. Hollis, and the staff of professors connected with the engineering and physical departments of the University, and conducted through the various laboratories. Prof. Trowbridge gave a demonstration with his remarkable high-voltage apparatus, from which sparks were drawn more than seven feet long. This apparatus consists of a glass plate condenser charged in parallel from a storage battery of 10,000 cells and 20,000 volts and which may be discharged in series with a multiplying ratio as high as 150, thus giving a voltage of 3,000,000. Prof. Trowbridge also showed the arrangement of apparatus for some experiments which he has recently completed with a view to determining the absorption of Röntgen rays by the atmosphere, which showed that the absorption is no greater than for light. Among the objects of interest shown in the laboratory of Prof. Trowbridge was a static machine built by Benjamin Franklin for Harvard.

Prof. C. A. Adams showed the visitors through the electrical engineering departments, in which there are a number of interesting pieces of apparatus constructed at the University. Among these is a small induction motor for which there are several rotors of different types, for the purpose of determining the effect of various factors in operation. This machine was designed and built by students. Prof. Hall explained the details of experiments upon which he is now engaged for determining the heat conductivity of iron. The two faces of a disk of iron have deposited upon them electrolytic copper, thus forming a thermopile by means of which difference of temperature between the two faces may be determined. The temperature of the water on each face of the disk is determined by means of the variation of resistance of small coils in the water in proximity to the faces of the disk.

Prof. Burke conducted the visitors through the several departments of the mechanical engineering laboratory and workshops, all of which are to be congregated in an engineering building soon to be erected at a cost of $170,000.

The party which visited the works of the New England Gas & Coke Company were made conversant with the Otto Hoffman process of gas and coke manufacture there in operation. This process differs from the usual one for the manufacture of gas in that the retorts are of larger size and are heated by gas. That part of the gas given out by the retorts which is suitable for illuminating purposes is collected in one holder, and the connection from the retort changed to a second holder at the point when the gas ceases to be of proper quality for illumination. The gas from the second holder is used for heating the retorts. While this process does not give as much illuminating gas per ton of coal as that in ordinary use, the cost of working is very considerably less and the coke from a given weight of coal is larger in quantity and better in quality. Consequently, if there is a market for the coke at a fair price the process is more economical. It does not appear

to have been demonstrated, however, that there will be a sufficient market for the coke should any considerable portion of the gas supply of Boston be made by the Hoffman process.

On Tuesday afternoon special cars left Copley Square for Norumbega Recreation Park, where steam launches were in waiting for members and the ladies. The launches were decorated with Chinese lanterns and a band of music accompanied the party. The evening was most agreeably spent on the water and Messrs. Ayer, Garratt, Morse and others of the local committee received many compliments for the happy manner in which the arrangements were carried out.

On Wednesday afternoon the members were taken in special cars from Copley Square and abroad the steamer "J. Putnam Bradley," kindly furnished by the City of Boston, to Pemberton. The visitors there boarded cars and were taken for a trip over the Nantasket branch of the New York, New Haven & Hartford Railroad. In the evening an informal reception was given to the members by Prof. Elihu Thomson at his home in Swampscott, near Lynn.

The first paper on Tuesday morning was by Mr. Allen V. Garratt on "The Elements of Design Favorable to Speed Regulation in Plants Driven by Water Power." It was pointed out that whereas in the case of steam governing the inertia of the fluid may be always neglected, the problem of governing a water wheel involves moving large volumes of a heavy, practically incompressible fluid, acted on by the force of gravity alone; the moving of ponderous gates, which must be done with absolute precision and great promptness; and adequate provision for the momentum and inertia of the moving water and mechanical parts. The properties of inertia were illustrated by mechanical analogies and the usual elementary formulas deduced, expressing the relation between energy, mass and velocity. These formulas were then applied to the case of water wheel working, and a numerical example solved to show how vast may be the amount of energy required to be absorbed when a wheel operating at full gate has a large portion of the load suddenly thrown off. A deduction from the considerations brought forward was that a water wheel governor to be accurate should at each instant of time hold the gates at such position that the power developed by the wheel due to the sum of the working head and that corresponding to the power being developed by the slowing water column, should equal the load upon the wheel. This, however, might not be found feasible, as the pressure developed in the closed pipe and wheel case might be dangerous for a gate too ponderous or too badly rigged to permit of the requisite promptness of motion.

From experience it is known to be impossible to so manipulate the water wheel gates as to keep the pressure constant on the wheel. One remedy for this condition which suggests itself is the use of large relief valves near the wheel case which will open and let the water escape if the proper static head is exceeded, or the use of a standpipe. Such a standpipe is of particular value in the case of electric plants where it is important that the comparatively large loads which go off and on for short intervals of time should not disturb the speed to any extent. The standpipe for best results should be very little higher than the water level in the ponds and located as near the wheels as possible. The use of fly-wheels in regulation is treated in the paper and the deduction of the usual formulas for this calculation is given and their application to water wheels illustrated by an example. The author stated, however, that he has never found it necessary in a very large practice where water wheels are set in an open flume to install a fly-wheel in order to obtain satisfactory speed regulation, as the various rotating parts of an electric plant such as water wheels, armatures, pulleys, etc., have a sufficient moment of inertia and angular velocity to enable a first-class governor to hold the speed within very satisfactory limits under any load changes which occur in the actual operation of the plant. If the design of the hydraulic part of the plant is bad, it is wiser to try to improve it than to depend on fly-wheel effect, which he considered a weak support at the best.

The paper gives consideration as to the proper design of a water-power plant, noting that the greater the angle of descent of the water in the flume the better the result, and that the draft tube with horizontal wheels should be short and as nearly vertical as possible. Owing to the external atmospheric pressure at the top of the draft tubes, and the strain brought upon them by a water hammer effect which may occur if the wheel is suddenly shut down, it is not safe to have a length of draft tube corresponding nearly to the maximum which is possible. The paper of Mr. Garratt touches upon all the more salient points involved in water wheel design and speed regulation, being, in fact, a valuable monograph on these subjects.

Part was taken in the discussion which followed by Messrs. Hopewell, Leonard, Hammer, Aldrich, Rice, Steinmetz, Bell and Goldsborough. It was pointed out that in cases where an engine and water wheel are working on the same load, the former may govern the latter. Several referred to the difficulties in governing where fluctuations are rapid, as in such cases the gate is apt to be overrun or underrun. Mr. Steinmetz gave as a qualification of an ideal governor one which shall respond quickly, but with a slow final action. Dr. Bell said that water wheel plants give as good regulation as steam engine plants, though high heads require extraordinarily accurate governors. Fly-wheels, he considered, were mainly applied to correct bad design, and it would be better to correct the hydraulic design and use better governors. As to better hydraulic design, the water should be led as directly and vertically to and from the wheel as possible, and the use of long flumes and draft tubes avoided.

In a paper on "The Protection of Secondary Circuits From Fire Risks," Dr. Cary T. Hutchinson gave a sketch of the principles which were involved and the various means that had been used and proposed for decreasing the danger from secondary circuits due to abnormal potential in such circuits. These means were classified as devices intended to ground, short circuit or open circuit the secondary when subjected to an abnormal difference of potential; grounded metallic shields interposed between the primary and secondary coils of the transformer; permanent grounding of the secondary system. Under the first class come the Cardew earthing device, the Thomson film cutout and the Stanley automatic circuit breaker. The objection to these devices is that they do not prevent the existence of abnormal potential, but merely aim to remove it quickly, and that they require time to act, and consequently can be regarded as but temporary makeshifts. The grounded shield is open to the criticism that it is not effectual with a cross outside of the transformer; it must be heavy enough to dissipate the energy of the short circuited primary quickly, or otherwise it will melt and itself cause a fire; and it affects the regulation of the transformer. The grounding of the secondary permanently is referred to as the only sure solution to the problem. With a system grounded on one side, the maximum difference of potential that can exist between any point of this system and earth under any circumstances is the voltage of that circuit. No cross or any failure of insulation of the primary or secondary circuits can raise the difference of potential of the secondary circuit and the ground above this. That part of the primary circuit touching a secondary circuit at once acquires the potential of the ground, or a potential differing from that of the ground by the voltage of the secondary circuit. The grounding of the secondary thus absolutely insures the safety of the circuit as regards abnormal pressures, and it makes permanent the condition that the protective devices above referred to seek to establish—devices that may or may not work, depending on many conditions.

At the conclusion of his paper Dr. Hutchinson offered a motion to the effect that the American Institute of Electrical Engineers favors the passage of a rule by the National Board of Fire Underwriters permitting the permanent grounding of one side of low-tension consumption circuits; and the abrogation of the rule that secondary wires must be installed under rules for high-potential systems when their immediate primary wires carry a current of potential of over 3500 volts, unless the primary wires are entirely under ground.

The discussion which followed the reading of Dr. Hutchinson's paper was participated in by Professors Thomson, Puffer and Goldsborough and Messrs. Goddard, Brophy, Greene, Steinmetz, Bell, Ayer, Kennelly, Hammer and Rice. With the exception of Prof. Goldsborough all favored the adoption of the motion offered. Prof. Thomson said that as early as 1887 he grounded, in his house in Lynn, the secondary of the lightning circuit, and that he adopted the film known by his name in consequence of criticism from the Underwriters. Mr. Steinmetz stated that grounding and not fusing was the proper protection against fire from abnormal voltage, and moreover that high-potential machines should have the frames grounded in order to avoid shocks to those working about them. Mr. Ayer said that ten years ago he grounded the secondary in his house through the intermediary of magnets which grounded the circuit in the case of any abnormal flow of current,

the use of magnets being necessary on account of Underwriters' rules.

Prof. Goldsborough did not consider grounding the secondary to be a step in the right direction, as it would leave a loophole for contractors with respect to proper insulation. He advocated that consumption circuits should be tested for three or four hours under 50 per cent. more than normal current, which would serve to develop defects in connections; and then connected to a transformer giving double the primary voltage. Referring to Prof. Goldsborough's objections, Dr. Bell said that it is not the initial insulation that causes trouble, but deterioration with time, and the same point was brought forth by several others.

Mr. Goddard seconded the motion of Dr. Hutchinson and said that the Underwriters would always highly appreciate recommendations having behind them the American Institute of Electrical Engineers. He considered the grounding of the secondary probably the best solution under the conditions referred to, as film contacts were subject to defects. He did not, however, favor grounding old installations and considered that the insulation proper of the circuit should not be lowered.

Capt. Brophy said that fifteen years ago he differed with Prof. Thomson as to the advisability of grounding, but that conditions have changed and he now saw no objection except in the case of the older installations. Upon vote the resolution of Dr. Hutchinson was unanimously adopted, thus in all probability definitely settling the long-mooted question of grounded interior circuits.

In a paper entitled "A Plea for a Working Standard of Light" Mr. S. Everett Doane advocated the appointment of a committee by the Institute to provide means whereby properly attested secondary standards in the form of incandescent lamps may be obtained by lamp manufacturers, central stations and others interested in commercial photometry. He wished to go on record as saying that in a very few years the incandescent lamp will in itself be adopted as a primary standard, and could be so adopted to-day if the lamp manufacturers would tell what they knew. Part in the discussion which followed was taken by Professors Puffer and Goldsborough and Messrs. Steinmetz, Rice, Kennelly, Blood, Clough and Hammer. Prof. Puffer referred to the large errors in measurements that may be introduced by the character of the photometric room. He does not think that the color of the amylacetate flame is good, and considers that the best results may be obtained by a large flame back of a small hole. Mr. Hammer suggested that provision for a standardizing laboratory might be obtained from a fund left for scientific purposes by Benjamin Franklin to Boston, and now amounting to $150,000. Upon motion of Prof. Goldsborough the matter of furnishing secondary standards was referred to the Council of the Institute.

A paper by Prof. W. E. Goldsborough on "The Magnetic Flux and Its Effect Upon the Regulation and Efficiency of Dynamo-Electric Machinery," considered the effect of the variation in density of the magnetic flux in planes at right angles to the mean path of the flux in an armature. It was shown then in the extreme case of an armature of which 80 per cent. of the surface is covered by the poles, and having little depth, the unequal distribution of flux may increase the core loss by 35 per cent. or more, and seriously affect the regulation.

In the discussion which followed Mr. Steinmetz pointed out that the case chosen for illustration was one not usually met with in practice, and that in fact experience had shown that there is no noticeable effect such as referred to in commercial machines. Mr. Blood called attention to the fact that even with large differences in density the amount of iron affected is small. Prof. Goldsborough added that the case was presented as one of more technical than practical interest.

Mr. Alton D. Adams in a paper on "Motor Speed Regulation" advocated a stronger effort on the part of manufacturers to introduce machines with efficient means of speed regulation. The practical methods to attain this end are the variation of magnet strength, and the variation in the arrangement of armature conductors to each other. A rheostat in the shunt magnet gives every desired speed above the minimum, but with constant armature capacity; while two or more separate windings and commutators on the armature give two, three or four times the minimum speed, with corresponding increase in armature capacity. The first mentioned method is sufficient for constant power at all speeds, but special proportions are necessary to avoid sparking with a constant armature reaction and weak field at the higher speeds. When the power and therefore the armature current vary directly with the speed, the armature reaction and copper loss, and field strength may be held constant at the desired speed if two or more separate windings and commutators are used, providing a reduction to one-quarter maximum speed is sufficient. In other cases it may be well to combine a multiple armature with variable field. Mr. Adams considers that the extra cost involved will soon be offset by the saving of energy effected.

In the discussion which followed Prof. C. D. Adams gave the conditions that apply in certain machine tool work, among which is that the same power is required at all speeds in lathe work. Mr. Adams stated that with two commutators and variable field, seven speeds can be economically obtained, and that with, in addition, three voltages, the number is increased to fourteen.

Prof. D. C. Jackson read a paper by Prof. J. P. Jackson and Frank F. Thompson on "Electricity in Coal Mining," which gives an interesting resumé of the present state of the application of electricity to that use. The subject is considered under the heads of mining, haulage, cutting or drilling, pumping and fan driving. It is stated that the use of direct-current machinery for pumping and fans has not been found satisfactory in many instances. The great advantage in the use of polyphase currents lies in the fact that they permit the use of a motor that is perfectly reliable under essentially all conditions to be met with in mining. Consequently the system of direct current for haulage and polyphase currents for other power seems without doubt to be the best that can be installed for large operations. Electric coal cutting in a large number of cases has not proved satisfactory, but in one mine where great trouble was previously experienced, satisfaction is now given by a new set of improved electrical apparatus. As to pumping, the conclusion is that when the pump may be of large capacity, and when it can be located within a reasonable distance of the steam plant, the steam pump will show greater economy.

The discussion, part in which was taken by Professors Aldrich, Adams, Stine and others, turned upon the relative merits of electric and steam pumping. Prof. Aldrich pointed out the enormously greater fuel economy of electric pumping, but the consensus of opinion seemed to be that since fuel economy was a minor question in this particular case, the great advantages of the steam pump in other respects gave it a superiority over its electric rival in mining work. As to the advantage urged in favor of compressed air—that of providing pure air for those working underground—Prof. Aldrich considered that this advantage was a minor one and could not compensate for an efficient system of draft ventilation which in all well-designed mines should be adopted.

The final papers of the meeting were two on electric automobiles. That entitled "Operating Cost of Horses and Electric Delivery Wagons in New York City," by Prof. G. F. Sever and Robert A. Fliess, will be found in full abstract elsewhere in this issue. The other paper, entitled "Electric Automobiles," was read by Mr. Elmer A. Sperry and illustrated by views projected on a screen. The statement is made that the storage battery of the present day even rivals the electric motor in its fitness and special adaptability to the automobile problem. It has a very large reserve power at instant demand, is entirely free from danger when fully charged, gives almost constant pressure throughout its capacity, may be charged in almost any hamlet in the country, and recent types may be quickly charged. Storage batteries have the advantage over compressed air in weight. Compressed air reservoirs having a capacity of .27 of a hp-hour weigh 85 pounds, and the air contained, 11 pounds, while a storage battery will develop 1½ hp-hours with the same weight. Tests have shown that ample adhesion on dirt and gravel roads, macadam, on the level and on curves, wet and dry, can be relied upon for any conditions liable to be met. The value of smooth tires for road traction is evident when one sees an automobile ascending a 20 per cent. grade on an ordinary gravel road, or rising easily over a 4-inch by 4-inch timber placed in front of one and then both the driving wheels, working as well on the wet portions as on the dry. The value of the compound gear is apparent, as it enables grades to be overcome that otherwise would require an inordinately large motor. The compound gear not only enables a small motor to meet the emergency, but has an important bearing on the storage battery, acting as a safeguard and enabling lighter plates to be employed. As to the charging of a battery, it is believed that the differential wattmeter system is best for ordinary use.

The discussion covered both automobile papers, and was participated in by Messrs. Lemp, Rice, Blood and Thomson. Both Mr.

Lemp and Prof. Thomson expressed opinions in favor of having a motor on each axle. The latter stated that this could be done and the weight not increased over that necessary for one motor, while there would be more economy, less wear and tear of battery and a maximum traction.

Mr. Lemp dwelt upon the importance of a safe steering gear which, while normally securely locked, should be capable of being quickly and easily moved. Mr. Blood stated that differential and direct-gear motor equipments would have about the same weight. Mr. Rice said that in New York there are at present eleven stations at which automobiles may be charged.

Operating Cost of Horse and Electric Delivery Wagons in New York City.*

One of the most valuable papers read at the recent General Meeting of the American Institute of Electrical Engineers was that of Prof. G. F. Sever and Mr. R. A. Fliess, which presented the results of an investigation, carried on during the past year in the City of New York, of the operating costs of the horse and electric delivery service, as at present instituted by the large department stores.

The first section of the paper gives the results obtained in an investigation which was undertaken to determine, as closely as possible, the average amount of work performed daily by a certain lot of horses engaged in the delivery service of a large dry goods store in New York City.

The large department stores have to keep in operation winter and summer, irrespective of the weather, a delivery service which must be as regular in the fulfilment of its functions as the local steam railroads and street railway systems are in the execution of their obligations. The nature of the service necessitates a highly organized system of delivery by means of small units capable of carrying 700 to 800 pounds over short distances and with considerable speed.

In the case of a wagon making three deliveries a day, the first delivery starts from the stable at 8 o'clock in the morning and arrives at the store a few minutes later—the stable, in most cases being not far from the stores. Arrived at the store, the wagon receives its load, which varies from day to day, but which will average the year round, not over 800 pounds. This load may be taken as the average load on all trips as the wagon leaves the store. The load decreases as deliveries are made, so that theoretically when the wagon has reached the store again, it should be without load. This, however, seldom happens in practice, as there are many C. O. D. packages in each delivery that must be returned to the store as collection could not be made. Also packages sent out on approval are called for and brought back to the store on each trip. It may be safely assumed, however, that the average load carried throughout any trip will not be more than 500 pounds.

On the longer trips only two deliveries are made a day, while in distant districts only one delivery is made. This latter is an all day route and the horse that goes up one day comes back the next—horses being changed at a local stable in the distant territory. One route, with three deliveries per day, it takes two horses for every delivery wagon—the horse that makes only one trip on any one day, making two trips on the following day. On a route having two deliveries a day, each horse makes but one trip a day. By means of odometer tests it was found that the mileage per wagon per day is nearly a constant, irrespective of the number of trips made. The explanation of the fact is that experience extending over many years of service, has taught those in charge the best method of district subdivision which will produce such a proportioning of the work that it shall be equally distributed among the units.

In determining the amount of work done per day by one of these delivery horses, it is essential to know the number of miles traveled by the horse, the average draw-bar pull of the wagon, and the average speed of the horse while in motion. For the wagons under consideration it was found that the average pull per ton was 60 pounds on ordinary cobblestones at a speed of seven miles per hour. On asphalt the draw-bar pull was found to be 40 pounds per ton at seven miles per hour. The unit under consideration was composed of a wagon weighing 1300 pounds drawn by a horse weighing 1100 pounds. Each wagon is provided with a driver and a delivery boy. The average weight of the driver may be taken at 150 pounds and that of the boy at 125 pounds. Hence the total weight of the unit without load is 2675 pounds. To this must be added the average load which may be considered as being 500 pounds. Adding this to 2675 pounds we have as the total weight of the unit 3175 pounds. The weight causing the draw-bar pull however is 2075 pounds.

In a test made the route was approximately one-half on cobblestones and one-half on asphalt. The true average draw-bar pull may then be taken as having been 50 pounds per ton during the test. Starting from the store, the average speed while in motion was 6.7 miles per hour. The actual running time was 1 hour 36 minutes; time at rest 2 hours 28 minutes. From the time the horse left the stable until he returned to it was 4 hours and 52 minutes. The time taken to load at store was 46 minutes. The time to run from stable to store was 2 minutes. Hence the actual time the horse was working from the time he left the stable until he returned to it was 1 hour and 38 minutes; time at rest 3 hours and 14 minutes.

Taking the draw-bar pull as found, at 50 pounds per ton, the number of foot pounds of work done by the horse in traveling 11 miles was $50 \times 58{,}080 = 2{,}904{,}000$ foot pounds, or at the rate of 1,781,596 foot pounds per hour, which is at the rate of 29,693 foot pounds per minute. This delivery horse then exerted nearly .9 of a standard horse power for 1 hour and 38 minutes. This was all the work done by this particular horse on this day. The following day this same horse made two trips over the same ground. The average work done per day the year round by a horse in this class of service, may thus be taken to be not over 16.5 miles at 50 pounds per ton, at a speed of 7 miles per hour. Experience has shown that a horse in delivery service in New York city cannot average over fifteen miles a day for six days a week and be expected to render good service for any reasonable length of time.

The length of the working life of a horse in this service is seldom over five years. At the end of this time he has depreciated in value at least 50 per cent. and cannot be sold for more than half his original cost. The time that a horse is in harness per day the year round, will not average more than seven hours, and we have seen that he is only working a small fraction of this time. For the purposes of this paper it is considered that a horse can do a greater amount of work, day in and day out the year round, than experience has indicated that he accomplishes, and therefore that it is possible for a horse to do 21 miles a day under a draw-bar pull of 50 pounds, at 7 miles per hour and be in harness eight hours a working day, the year round. The number of foot-pounds of work done per day by a horse, under this supposition, would be 5,280,000. This is at the rate of 29,333 foot pounds per minute, or the horse is working at the rate of .89 of a standard horse power for three hours per day, referring only to the time in actual motion.

As to the cost of horse service the accompanying table gives the actual cost per day, to a stable in the city, for a wagon and horse, the stable being that of a large dry goods house:

THE COST OF MOVING A TON A DISTANCE OF A MILE ON LEVEL GROUND, IN LIGHT DELIVERY SERVICE IN NEW YORK CITY.

1.	Cost of food per day for one horse	32.00 cts.
2.	Interest on cost of wagon (at 6% per annum) per day, original cost of wagon, $312	5.13
3.	Interest on cost of horse (at 6% per annum) per day, original cost of horse, $125	2.06
4.	Interest on cost of harness (at 6% per annum) per day, original cost of harness, $55	.90
5.	Part of stable rent charged to each horse per day.... (Cost of stable, $40,000. Int. at 6% = $2400.) 46 horses in stable, part of rent chargeable to horses = $1,578.55.	9.39
6.	Part of stable rent chargeable to each wagon per day, 24 wagons in stable..... Part of rent chargeable to wagons = $822.85.	9.39
7.	Part of cost of attendance chargeable to each horse 4 men to take charge of 46 horses at $11 a week per man—$44 a week for care of horses.	13.66
8.	Shoeing per horse per day ($2 per month a head, the year round)	6.60
9.	Driver per wagon per day, $12 per week	171.42
10.	Boy helper, $8 per week	114.28
	Total cost of 1 wagon, 1 horse and attendance per day	$364.83 cts.

*Abstract of a paper read at the Sixteenth General Meeting of the American Institute of Electrical Engineers.

Assuming 500 pounds as the average load carried by any one wagon per day, the total weight of the unit which causes the draw-bar pull as found before, is: Wagon, 1300 pounds; driver, 150 pounds; boy, 125 pounds; load, 500 pounds; giving a total of 2075 pounds. Hence, draw-bar pull being taken as 50 pounds, the cost to move 1 ton 21 miles may be taken as 364.83 cents, the cost per ton-mile being then 17.373 cents.

In another case where two horses and a delivery wagon are considered, and assuming the most ideal conditions, the cost of delivery per pound was .17856 cents. If it is assumed that in doing this work the wagon was out 12 hours and is in motion one-half its time, going at a speed of 7 miles per hour while in motion, then the wagon will cover 42 miles per day. Under these conditions the cost per ton-mile is 10.2 cents This is also the cost per car mile. If we consider the load only, it costs 10.2 cents. per 500 pounds per mile, or at the rate of .0204 cents per pound per mile.

If it is assumed that on the three trips the deliveries average 50 per trip, then 150 deliveries were made per day. This is at the rate of 25 deliveries an hour or 1 delivery in 2.4 minutes. It is well to call attention to the fact that a wagon sometimes is called upon to make as high as 100 to 150 deliveries on a single trip and the average rate of delivery may be taken as not over 25 deliveries an hour. Hence, it is evident that the case considered above is for ideal conditions only. The weight per package assumed is 16 pounds, and it is not often that the packages will average over 10 pounds.

The results given above, it will be understood, represent the lowest possible figure under the conditions now existing in the stable under consideration. Therefore, if in making a comparison between the costs of operating a horse and an electric delivery service under identical conditions, the above figures are used, all possibility of error in favor of the electric automobile seem to be eliminated.

The second section of the paper deals with tests of automobiles in the streets of New York City. Over 60 miles were covered during the tests recorded below, and all grades between the lower section of the city and Washington Heights were surmounted with the greatest ease. During the tests, various conditions of weather were encountered, including heavy rain, strong head winds and muddy streets, as well as very clear weather, no wind and dry streets. During the series of tests, no accidents of any kind happened. It was not necessary at any time to stop the vehicles for repairs—all the mechanical and electrical parts performing their functions with the utmost ease, and with practically no noise, and absolutely no odor.

The first tests were made upon a vehicle built for a large dry goods store in New York City. The vehicle was intended for the delivery of light goods about the city, and was to be placed in competition with horse delivery service of the same class. The results obtained show the instantaneous power consumption with this vehicle, while traveling over the same ground, at the same speed as recorded on two different days. The conclusion from the tests are that the power of consumption is not greatly affected by change of pavement, as from cobble stones to asphalt. There is, however, a slightly greater power required on wet macadam than on dry, and more power is required on macadam than on asphalt or cobbles. On grades the speed of the vehicle is very much reduced and the power required to propel the vehicle at the reduced speed is very large—which is quite natural.

The average of ten readings gives as the power consumed on level asphalt, 85.3 volts and 23.1 amperes. These ten readings were selected with the idea of eliminating up or down grades. The lowest ammeter reading taken was 20 and the highest 26. Above and below these readings the vehicle was on perceptibly up or down grades. It may be well to note that this wagon was equipped with solid rubber tires; these, as is quite generally recognized, absorb slightly less power than pneumatic tires.

On a test in very fine weather, the run was one of 6.25 miles over a continually ascending route. The watt-hour-meter reading during this test showed a consumption of 1364.22 watt hours. The wagon alone was weighed on balanced coal-scales and was found to weigh 3750 pounds. On this trip it carried three passengers and the instruments used, giving a total weight of 4200 pounds. The time actually in motion was 52.75 minutes, and, therefore, the average speed in miles per hours was 8.44 miles; the watt-hours per car mile were 218.28; and the watt-hours per ton mile were 103.95. These results were obtained during a run which was always tending up hill as was noted above. The average of the 27 readings was 84.72 volts and 26.25 amperes.

A run was made in the opposite direction to that mentioned above, starting on the high ground on which that test terminated, and extending over 7.24 miles. The watt-hour-meter showed a consumption of energy on this run of 1243.38 watt-hours. The weight was the same as previously given, namely 4200 pounds. The time and actual motion was 58.5 minutes. The distance traveled was 7.24 miles. The average speed per hour 8.08 miles. The watt-hours per car mile were 171.74, and the watt-hours per ton mile, 81.08. Combining the results for the two tests for a total distance of 13.49 miles the average was : Watt-hours per car mile, 195.01, and watt-hours per ton mile, 928.75. The results were obtained under the ordinary service conditions and can be duplicated at any time.

Some special tests were made to determine as accurately as possible the lowest value for the power consumption at the different speeds, over a block paved with asphalt which was fairly level. The average readings obtained for three different speeds of the wagon were, for 10.5 miles per hour 82 volts, 21 amperes; for 5.4 miles per hour, 42 volts, 19.5 amperes; for 2 miles per hour, 21 volts, 19 amperes.

At 10.5 miles per hour the rate of travel was 15.4 feet per second and the rate of work 1722 watts, or 2.3 h.p. The draw-bar pull was then 52.44 pounds or at the rate of 39.26 pounds per ton. At 5.4 miles, draw-bar pull was 36.3 pounds per ton. The value of the draw-bar pull at 10.5 miles is probably very closely approximate to the value that would be shown at all speeds between 5 and 12 miles per hour if a dynamometer was used.

We may take 105 watt-hours per ton mile as quite within the reach of actual practice under service conditions to-day, but a more conservative estimate of 120 watt-hours per ton mile as a basis upon which to calculate the operating costs of electric vehicles for delivery service is assumed. Under ordinary conditions a well-designed electric delivery wagon should not consume over 120 watt-hours per ton mile. A small carriage, tested under most unfavorable circumstances, did not reach 120 watt-hours per mile. The weight of this vehicle was 1200 pounds, and with one passenger and the instruments it weighed 1400 pounds. Its draw-bar pull was found, by a dynamometer, to be over 42 pounds at 8 miles per hour on level asphalt. This is at the rate of 62 pounds per ton, and is approximately the same as found for ordinary horse delivery wagons on cobble stones. The distance traveled was 9.45 miles; watt-hour meter record, 771.5; average speed, 8.0 miles per hour; watt-hours per ton mile, 116.5. It is interesting to note that even with an abnormal pull the watt-hours per ton mile were only 116.5.

A fairly severe test, so far as hill climbing and bad roads are concerned, was also made, the vehicle taking en route a long hill. The hill climbing part of the trip was over a very bad macadam road surface. The hill was surmounted twice during the trip and the carriage covered 14 miles. The distance traveled was 14 miles; time in actual motion, 1 hour 47 minutes; average speed, 7.8 miles per hour; total watt-hours recorded, 1162.29; watt-hours per ton mile, 118.57. It is worthy of note that with all the hill climbing, the bad roads and the large friction loss due to bad design, the watt-hours per ton mile only reached 118.57. From the foregoing, 120 watt-hours per ton mile would seem to be a conservative estimate for the power consumption of well designed electric delivery wagons in New York City under ordinary service conditions.

Taking 120 watt-hours per ton mile as a basis on which to compute the power consumed by an electric delivery wagon, a comparison is made with horse service. It is shown above that the total cost per day for 2 horses, 1 driver and 1 boy, was 428.54c. The wagon was to travel 42 miles a day—being an average of 21 miles per day for each horse. The time in motion was assumed to be 6 hours. An electric wagon with an average speed of 9 miles an hour, could cover this distance in 4.66 hours, thus saving 1.34 hours —the other conditions remaining the same. The cost per day for the electric, assuming cost of power at 5c. per kw-hour, is 71.28 cents, assuming a power consumption as 120 watt-hours per ton mile. The total weight of wagon, driver, boy and load being 2263 tons, the watt-hours per car mile are 271.56, and for 42 miles 11,405-kw hours. Taking battery efficiency as 80 per cent., the total power to be paid for is 14.256-kw hours. The interest on cost of wagon per day is $21.4, or 6 per cent. on $2300. The interest on stable rent for one wagon is $9.39, wages of driver, $171.42, and of boy, $114.28. The total cost per day for 42 miles, 1 wagon, 1 driver

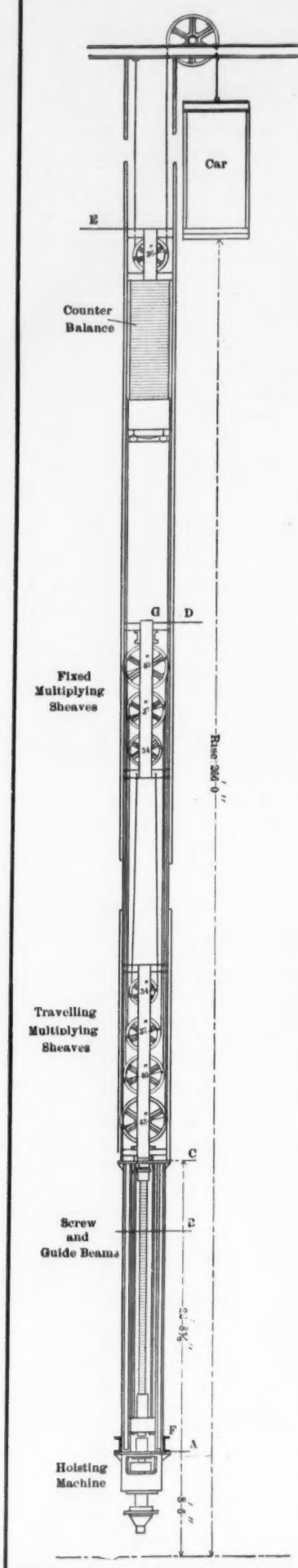


FIG. 13.—TYPE K, VERTICAL ELEVATOR.

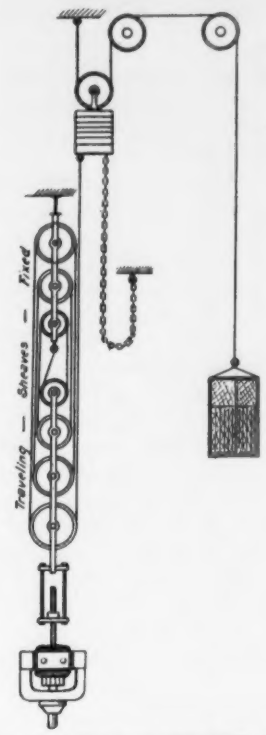


FIG. 12.—DIAGRAM OF SHEAVES, ETC.

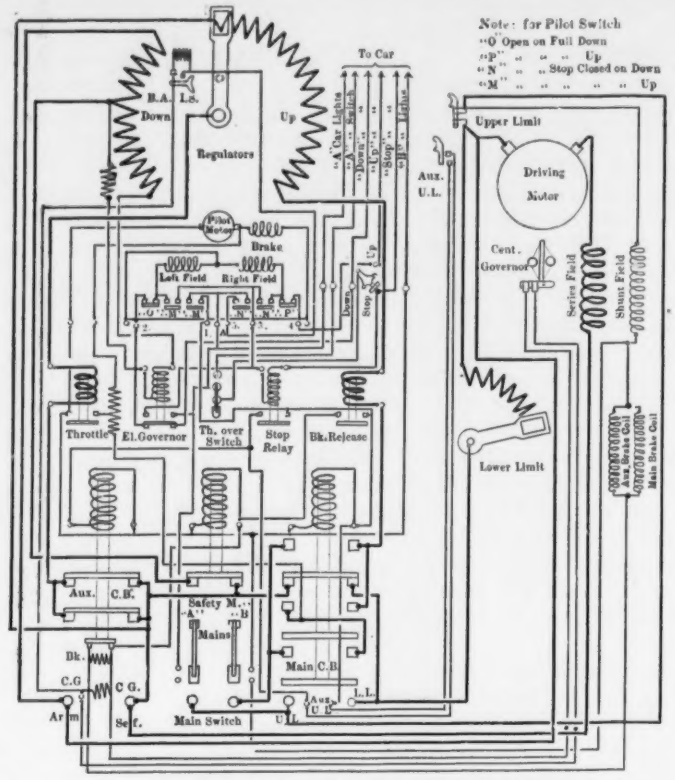


FIG. 15.—WIRING DIAGRAM OF ELEVATOR CONTROL.

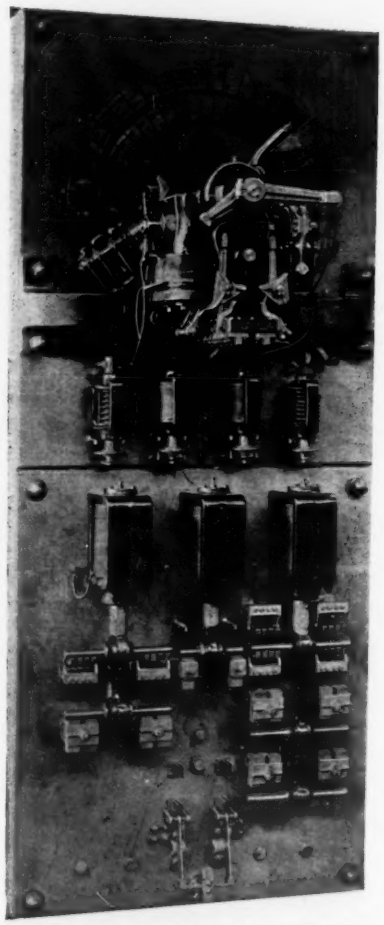


FIG. 14.—ELEVATOR CONTROLLING PANEL.

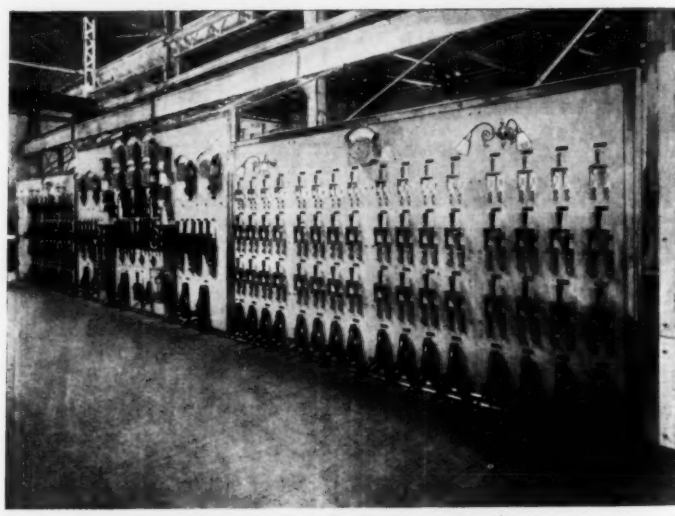


FIG. 16.—SWITCHBOARD; FRONT VIEW.

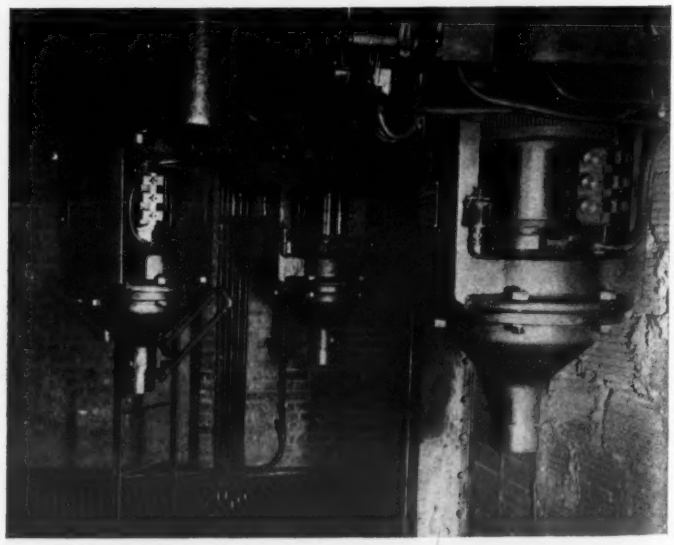


FIG. 11.—ELEVATOR MOTORS; LOWER END.

VIEWS OF SOME OF THE LIGHTING AND TRANSPORTATION FEAT

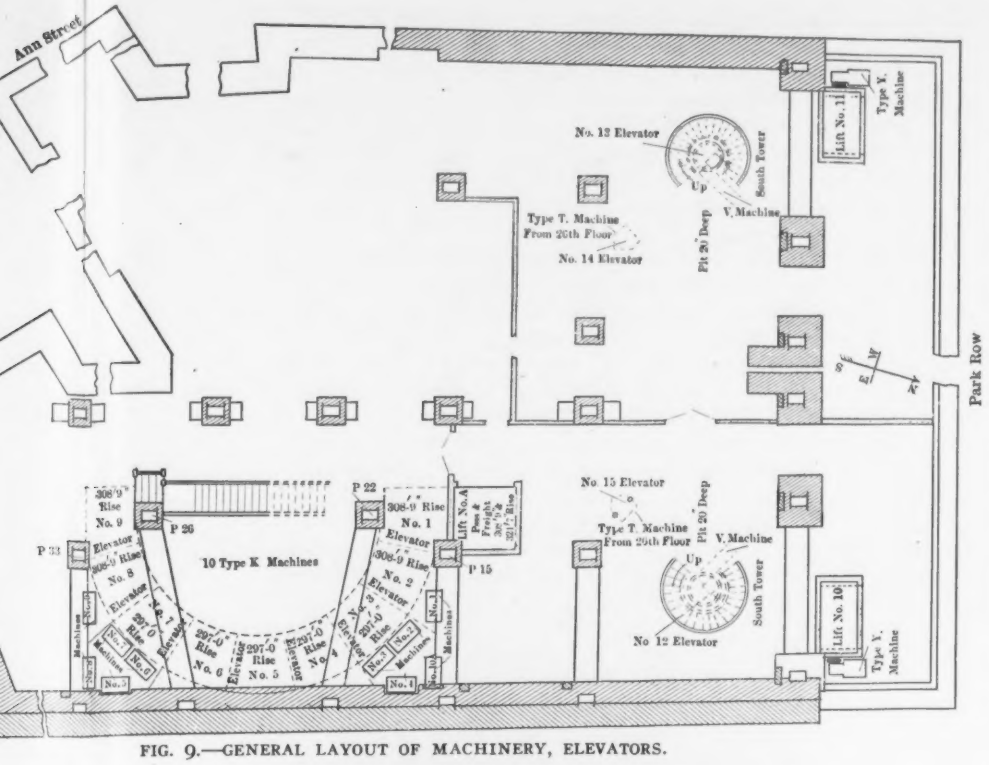


FIG. 9.—GENERAL LAYOUT OF MACHINERY, ELEVATORS.

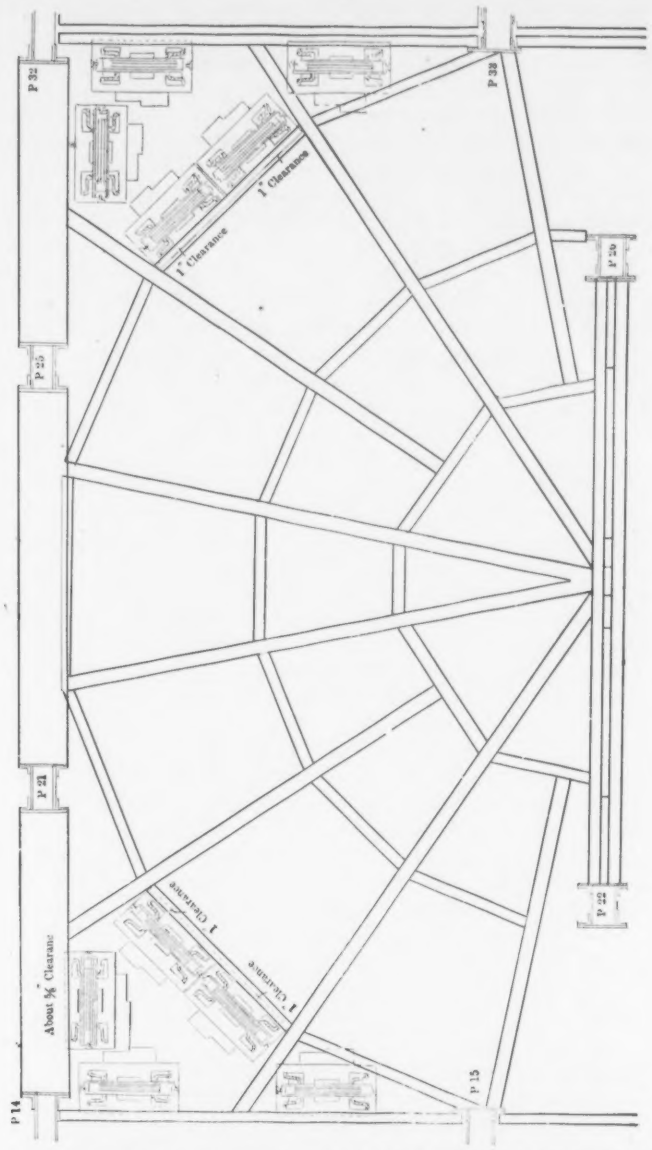


FIG. 10.—ARRANGEMENT OF VERTICAL ELECTRIC ELEVATOR MACHINERY.

FIG. 18.—BACK OF SWITCHBOARD; POWER END.

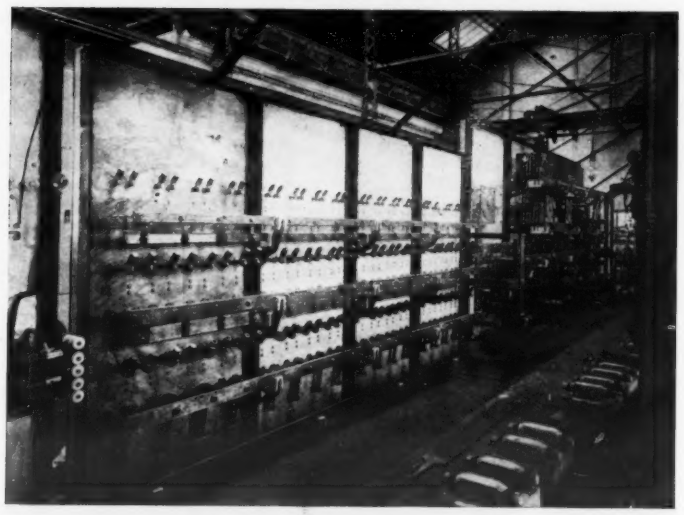


FIG. 17.—BACK OF SWITCHBOARD; LIGHTING END.

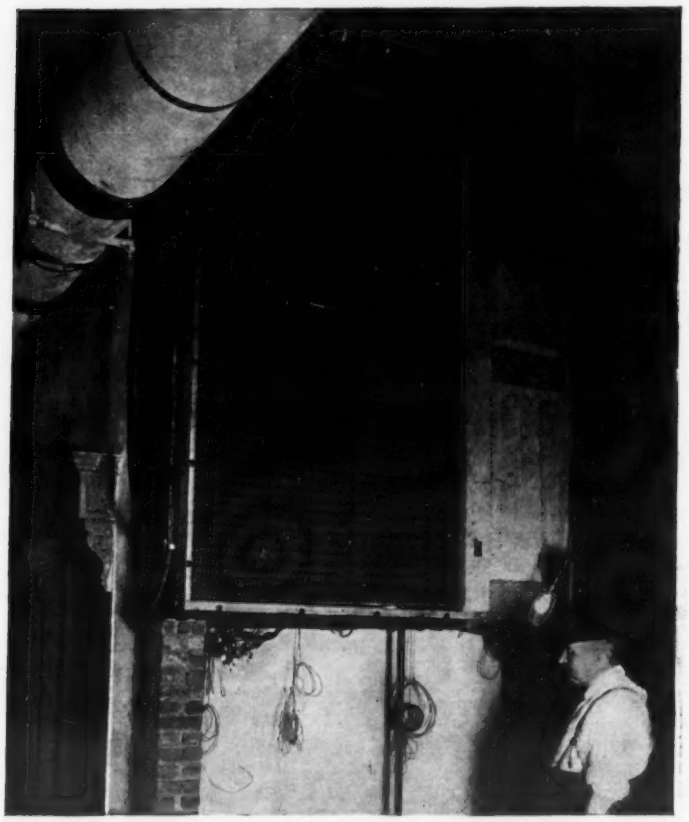


FIG. 19.—MAIN INTERCONNECTION BOX.

and 1 boy is therefore $3.87 cents, or the cost per pound of delivery is .16158c., or .01698c. less than the figures for the horse. The cost per car mile is 9.232c. or .968c. less than for the horse. Cost per ton mile is 4.08c., or 6.12c. less than for the horse service. If we consider the load only, it costs 9.232c. per 500 lbs. per mile, or at the rate of .018464c. per lb. per mile or, .00194c. less per lb. than for the horse service.

Attention is called to the conditions under which this comparison is made. The horse is supposed to be able to average 21 miles per day, doing this at the rate of seven miles per hour, under a draw-bar pull of 50 lbs. In other words, he is doing work at the rate of .89 of a standard horse-power for three hours per day. The automobile, on the other hand, is to do 42 miles a day at the rate of nine miles per hour, and the cost of power is assumed to be 5 cents per kw-hour. Under these conditions the automobile can do the work of two horses in 1.34 hours less time than they can do it, with a saving of .01698 cents per pound of goods delivered or at a saving of 40.752 cents per day on a delivery of 2400 pounds.

A comparison is made between the two systems under conditions which actually exist to-day. The delivery horse does not average 18 miles per day during the year, but it is assumed that the horse does travel this distance per day. Each wagon will go 36 miles a day under this assumption; hence the total mileage of the wagon for the year will be 11,268 miles. This assumes that on Sundays the wagon does not go out. Then for 52 days a year, at least, the horses have to be fed without any work in return. This, of course, is a condition not met in electric automobile service.

The cost per day for the two horses, wagon, driver, etc., necessary to accomplish 36 miles a day was found to be 428.54 cents. The cost of covering 11,268 miles will then be $1,562.20. Here it must be remembered that 365 days have to be taken. The cost per car mile is then 13.86 cents. When we come to consider the electric automobile for a year, covering 36 miles a day, its advantages are brought out very clearly. Since the vehicle, owing to the nature of its construction, does not consume any energy when not in motion, it follows that, during the periods of rest, while deliveries are being made and the wagon is being loaded, there is no more expense than that incidental to wear and tear. This, of course, is common in amount to all vehicles of the same class and may be considered the same in each case. That a slight loss does occur when the vehicle is at rest, due to local action, etc., in the batteries, is true, but this loss is considered when the efficiency of the battery is taken at 80 per cent. The factor most important in determining the expense of operating an electric vehicle is therefore the price that must be paid for the power. This is a very variable factor, indeed, and the price per kw-hour will determine in all cases the amount of saving that will be possible through the use of electric automobiles.

A stable taking power from a large central station would, if of average size, add a load which, if properly distributed as it easily could be, might become a considerable factor in straightening out the load curve of the station. If several stables were supplied from the same central station, this load would become a great source of economy to the station, and power could be sold to them at a very low figure. Owing to the regular nature of the work imposed upon the wagons in delivery service it could easily be arranged to have the electric vehicles charged at night after the heavy load is off the station. They might also charge early in the morning and at noon or at periods that experience would indicate were the most advantageous for the station, the time of deliveries being adjusted to suit the new conditions. In this way a stable should be able to buy power at from 1 to 2 cents per kw-hour.

Assuming the cost for a kw-hour as 3 cents, the power consumed per ton mile as 120 watt-hours and the weight as 3500 lbs., for the wagon. Taking the average load as 500 lbs., weight of driver as 150 lbs., and that of boy as 125, the total weight is 4275 lbs. The cost for the electric vehicle to cover 11.268 miles is therefore as follows:

Cost of power for 11,268 miles at 3 cents, $108.35; interest on cost of wagon at 6 per cent. for year (cost of wagon, $2300), $78.05; interest on stable rent for 1 wagon, for year, $34.28; wages of driver, $625.68; wages of boy, $416.83, or a total cost of $1,263.15 per year. Then the cost per car mile is 11.21 cents; per ton mile, 5.246 cents; cost of power per mile, .961 cents; per power per ton mile, .45 cents.

Hence the saving, considering that the horse drawn wagon does 36 miles a day 6 days a week, is 2.65 cents per car mile in favor of the electric vehicle, which means a saving of 95.4 cents per day per wagon. Owing to the greater speed of the electric vehicle, it takes only 4 hours to travel 36 miles as against 5.14 hours for the horse. This is a saving of 1.14 hours per day, or of 356 hours a year.

The conclusions of the paper are, that in light delivery service in large cities, when a number of units are employed by individual firms, the adoption of the automobile would seem to be merely a question of time. For this kind of service it seems pre-eminently the best solution. It is cheaper to operate than horse service, and the mechanical problems have been so far solved as to make the vehicles commercially successful. Though, as stated before, it is not the intention to discuss depreciation, it may be noted that the comparison of the costs of operation as regards food, cost of power, etc., would show a saving in favor of the electric delivery wagon, in one year, of 20 per cent., which, under more favorable conditions as to the price of power, might easily be increased. Assuming, for the moment, that the depreciation in a year is 25 per cent. for the electric system, and, under the same service conditions, is only 10 per cent. for horse traction, we still have a saving of 5 per cent. in favor of the automobile. The advantages that will arise from the substitution of mechanical propulsion for horse traction on a large scale, are so well known and understood, that any extended consideration of the subject seems unnecessary. Among the many advantages, however, the following would seem to be the most important.

1. The hygienic condition of large cities will be improved, and the cost of street cleaning will be decreased. 2. The wear and tear on pavements and streets will be reduced, and the use of rubber tires will lessen the noise in the crowded streets. 3. The traffic in cities will not be as congested, owing to the saving in room now occupied by the horse. When we consider that there are approximately 200,000 horses used in New York City, alone, and that a horse increases the length of a unit by nine feet, it can be readily appreciated how great a saving will be effected. Taking the average width occupied by a horse and shafts as two feet, it is seen that 200,000 horses occupy about 3,600,000 square feet, or 82.6 acres of valuable street room. 4. When the use of automobiles has become more general, the cost of operation will be reducted. This is true for the reason that with an increased output of wagons, the price will decrease, and with the greater use of power, the cost of it for this purpose will diminish. 5. The danger of accident from runaways will be eliminated.

Automobiles as Mail Wagons.

It is evident that the United States government looks favorably upon the future of automobilism. The first attempt ever made in the United States to collect mail with an automobile was made in Buffalo on July 2. It was a great success, mail from forty boxes, covering a territory six miles in length, was collected in less than one-half the time necessary to cover the same route with a horse and wagon. The experiment will be continued, and if it proves as great a success as anticipated a number of automobiles will be placed in regular commission in connection with the postal service in Buffalo and other cities.

International Physical Congress.

The French government officially announces that an international congress devoted to the subject of physics, will be held in Paris during the week beginning with Aug. 6, 1900, in the Palais des Congres. The programme will consist of three parts: 1. Reports and discussions on such subjects as the definition and determination of certain units like that of pressure, scale of hardness, heat quantity, photometric magnitudes, electrical units not yet defined, etc.; also the subject of national laboratories and a discussion of the bibliography of physics. 2. Visits to the exposition, to laboratories, etc. 3. Discussions of new subjects. The ticket of admission to the congress will cost 20 francs ($4.00) and gives the right to participate in the work, to attend all the meetings, and all visits; it also entitles one to a printed copy of the transactions of the congress. The invitations are being sent out by Prof. Cornu, the president of the Organizing Committee. Those who anticipate attending this congress are requested to send their names and addresses to the secretary, Mr. C. E. Guillaume, Pavilion de Breteuil, Sevres, France. Among the names of the members of the Committee on Organization, besides the above, are d'Arsonval, Becquerel, Blondel, Joubert, Lippmann, Mascart, Pellat, Potier and Violle.

Third Annual Convention of the Independent Telephone Association.

MONDAY, JUNE 26.

BY far the most successful meeting in the history of the independent telephone movement was the third annual convention of the Independent Telephone Association, held June 26, 27 and 28, at the Auditorium Hotel, Chicago. In point of attendance, enthusiasm and enjoyment no gathering of the kind has ever equaled it. In results promised and accomplished it stands alone. But for the drawback of a bad day when excursions were on the programme, it would deserve to rank in every way as an unqualified success. While many incidental benefits were received by the persons attending the convention, the main object of the gathering—closer union of the independent interests—was the one most fully accomplished. Although this result of the convention is largely on paper, it seems almost certain that the arrangements entered into at the meeting will be carried out, for an amalgamation of the independent telephone interests in many of the Middle Western States. Ohio, Indiana, Illinois and Michigan are practically certain to go into the deal. Headquarters will be established in Chicago, presumably under the new franchise granted to the Illinois Telephone & Telegraph Co. President Thomas, of the association, is authority for this statement. Before the closing of the convention, he said in an interview: "Following this meeting the Long Distance Company of Illinois is to be organized, with Chicago as its central exchange. There is already an independent company in this city, known as the Illinois Telephone & Telegraph Co., which will probably be the central exchange of the Illinois company. How soon this company will put in its switchboard I cannot say. The Illinois company will be connected by long distance lines with the companies now organized in Michigan, Indiana and Ohio, and trunk lines will be built from Cleveland to Chicago, and also to Detroit, Indianapolis and other large cities. The company in Ohio is known as the United States Company and that in Michigan is the New State Telephone Company."

Later, at the close of the three-days' meeting, President Thomas said: "The function of the association is to advise and to point out what is best. We have done this and shown the way for consolidation. It will doubtless follow as the result of the gathering, but not as a part of it."

So much for its probable results. The tangible effects and accomplishments of the convention were plain. First, the opening day saw the election of officers and the decision for a new and more aggressive policy. The second day gave great encouragement to the members of the association as the result of the figures of growth submitted by President Thomas and H. D. Critchfield, and carried considerable instruction through the series of technical papers listened to. The last day afforded information regarding the manufacturers and supply men and their methods, and brought forth, in spite of rain, the pleasures of a jaunt by carriage and steamboat about Chicago. The gathering ended by a huge banquet.

Monday was arrival day. All day long the delegates, supply men and officials kept arriving. Most of them repaired at once to President Thomas' room in the Auditorium Annex, where they signed the register of the association, were made acquainted with the location of the exhibits and the headquarters in the banquet room of the Auditorium, and were told the programme of the meeting. By late evening the bulk of the members had arrived, though scattered individuals and delegations kept on coming until the afternoon of the last day. Nearly 300 persons signed the register before the end. On page 62 are given the names which were affixed to the official list during the course of the three days.

Monday evening the principal business meeting of the association was held. At 8 o'clock the Executive Committee and the Advisory Board gathered in the parlors of the Auditorium Annex and went into secret session. The business of the last year was settled up, and the lists of officers and committees for the coming year decided on. The result was the choosing of the following officers, afterwards accepted by the association: President, James M. Thomas, Chillicothe, O.; first vice-president, Charles Flower, Detroit; second vice-president, I. A. Lumpkin, Mattoon, Ill.; third vice-president, George T. Hewitt, Cedar Rapids, Ia.; secretary and treasurer, S. P. Sheerin, Indianapolis, Ind.; first assistant secretary, G. W. Beers, Fort Wayne, Ind.; second assistant secretary, S. E. Wayland, Wilkesbarre, Pa.

The Advisory Board was practically selected at the same meeting, though not announced until the evening of the banquet. It is made up as follows: James M. Thomas, Chillicothe, O.; S. P. Sheerin, Indianapolis, Ind.; H. D. Critchfield, Mount Vernon, O.; E. B. Fisher, Grand Rapids, Mich.; Hugh Dougherty, Bluffton, Ind.; H. C. Young, Columbia, Pa.; W. B. Seaton, Ashland, Ky.; W. H. Durin, La Crosse, Ia.; T. W. Sennott, Chicago.

TUESDAY, JUNE 27.

The second day of the convention was devoted, morning and afternoon, to a general meeting of the association, held in the banquet hall of the Auditorium. Over 300 persons were in attendance. This gathering was the most important in its results of any during the convention. State associations were formed by the delegates from three States, and the finances of the association were put on a more secure basis.

President Thomas' annual address was to many the feature of this meeting. The keynote of it was the advice to members to unite, to fear nothing and to be confident. He gave statistics of growth of the anti-Bell movement, and urged union by saying: "We have accomplished to a remarkable degree all the objects set forth, but have now reached a condition where there is greater demand than heretofore for a close organization which has at its command all the facilities and men necessary to meet the attacks of our opponents in their fight of existence in certain territory of the United States."

To show the wonderful growth of the independent telephone business, President Thomas then gave some statistics as follows: "We had at the time of our last meeting, according to our statistics, about 1100 independent telephone exchanges in operation in the United States. The year just closing has started into operation more than 1200 in addition thereto, making a total of more than 2300 telephone companies under the independent system now in operation. There are several hundred more in process of construction, and a great number of companies which have franchises or are seeking franchises, which have not yet begun to build. While the number of telephone exchanges more than doubled the past year the investment more than quadruples on account of the fact that larger exchanges, with more expensive equipment, were among the number of increase. We have now in operation many thousand miles of toll lines. The various independent companies are operating more than 575,000 telephones, not including those operated outside of public exchanges and toll-line companies. There is to-day already invested in independent telephone exchanges and toll lines more than $55,000,000, while many millions of capital are engaged in manufacturing and furnishing supplies to the operators."

President Thomas closed his address by an admonition to the members of the association to be ever alert in the battle which was being fought and which would thicken in the next year.

The technical papers presented were not at all numerous but possessed considerable merit and interest. H. D. Critchfield supplemented the president's annual address by further statistics regarding the growth of the independent telephone interests as compared with the Bell companies. S. P. Sheerin, of Indianapolis, ventured a prediction which is worthy of note. He said:

"I would like to make a bit of prophecy right here—that is, a thing that will not be possible twenty years hence. The lawmakers and courts of this country will not continue to allow a patentee to deny the benefits of his invention to people who are willing to pay for it. It is all right for the patentee and his assigns to have the right to enforce ample compensation, but this country will not continue to permit oppressive denial of benefits to men who are willing to pay for them." His paper was on "Long Distance Toll Lines."

Mr. Sheerin's paper was discussed by Mr. DeLand, who called attention to the desirability of working toll lines on the Sabin system of cutting up the minute into halves and three-quarters, and giving thus a rate of ten cents where three minutes would cost 30 or 35 cents. A man can often close a deal in twenty or thirty words, occupying the line less than a minute.

Messrs. Baird, Fisher, Harvey, Ottenstaat, Hill, Reutinger, Farr, Critchfield, Cockrell, Tucker and others discussed methods for reconciling the interests of different companies handling a toll message. In some instances, as in Illinois, the company originating the business keeps the tolls outward, and handles inward messages for nothing, this applying even with three companies on a line. Mr. Hill stated that in Iowa this reciprocal plan worked very well. Mr. Farr stated that in one case, they charged 60 per cent. on outgoing business and the other company got 40 per cent., and vice versa. In all other instances, the reciprocal basis applied and saved bookkeeping. Working through three companies, there was a scale of 50, 25 and 25 per cent. Mr. Reutinger urged that the reciprocal plan was not fair.

It is an easy matter to have a card rate and divide up on the mileage. They measured by the air-line mileage and divided up easily between five or six interests. Mr. Critchfield held that this was too cumbersome, and he described a system operated by five companies covering eleven adjacent counties. They make a certain rate from any point in one of the counties to any point in the next adjacent county. Ordinarily the rate to the first station is ten cents. But that is not material for the purposes of this statement. It may be fifteen, twenty, twenty-five cents, or whatever it may be. For instance, a message from five miles inside of *A* county goes entirely across *B* county next adjacent; *A* and *B* divide that message equally except 25 per cent. of it goes to the originating company in all cases as an inducement for all companies to strive to create business on their lines. The originating company gets 25 per cent. of the toll charged, and the remaining 75 per cent. is divided between the companies operating in the two counties. One company may carry that message twenty-five miles and the other only carry it five. But the next time a message starts in *B* county and comes back to the same point in *A* county, *A* gets the benefit of its half of the 75 per cent. for carrying the message five miles, while the other company carries it twenty-five miles, and that equalizes the two messages. If it is carried through three counties, for instance, starting from the line in *A* county over to *C* across *B*, that message is divided in the same way; 25 per cent. to the originating company, and the remaining 75 per cent. is divided equally between the three companies over whose lines the message passes. In that way you only have to keep track of the counties. The next day a message comes back over the same line and it is equalized again. Experience has shown that the variation from an exact division under that method is so slight that it will not begin to pay the cost of the books and the bookkeeping undertaking to keep it on the mileage basis. Mr. Critchfield warmly advocated more toll line systems.

Other papers were: "Operation and Maintenance," C. L. Boyce, Grand Rapids, manager Citizens' Telephone Company, Grand Rapids; "Essentials of Telephone Construction," Maxime Reber, Cleveland, engineer Cuyahoga Telephone Company, Cleveland; "Developments of the Telephone Industry," H. D. Critchfield, Mount Vernon, O., counsel United States Telephone Company of Ohio. In the discussion of the paper by Mr. Boyce, on "Operation and Maintenance," Mr. DeLand made the useful suggestion that a committee might be appointed to formulate specifications for franchises, so that the new companies would not have impossibilities inflicted on them in the way of rates, in the shape of ordinances limiting rates to $12 or $15, and in one case as low as $9 a year. He said: "It seems to me if the association would take that question up, that in a very short time all our franchises would be granted without the limitation clause. Then we could give service far superior to anything that we now have, throw away our present equipment, put in improved equipment, and if necessary charge, say 25 to 30 per cent. higher rates than we are getting at the present time. If you can get $24 to $36 where you have 100 to 500 subscribers, your costs will be low if you build good lines."

Mr. Critchfield states that "about 200 to 250 telephones is the sized exchange that can be operated at the lowest expense per telephone." Mr. Hogue insisted on the fact that there is an endless variety of conditions governing each case. He deprecated the popular idea that a franchise is a wonderfully valuable thing per se. "My experience with franchises has been that they amount to nothing until you invest a large amount of money in developing them. When you have got the property in shape to show an earning capacity then perhaps you can get an investor to look over your proposition." Mr. Fisher raised a note of warning about giving the idea that telephone service can be done cheaply. "I would have each one of you say to your neighbors and friends that they must not get the impression because they are operating plants in towns of five or six thousand inhabitants successfully at a given rate that they can come to a town of forty or fifty thousand and operate at a greater profit because of the larger number of possible patrons." He added that visiting officials from other places ought not to be sent away misinformed, and that "we must not get our rates so low as to prevent our giving just as good service as anybody in the world can give."

SOME OF THE ATTENDANTS.

Mr. H. D. Critchfield then read his paper on the development of the telephone industry, in the course of which he said:

As attorney for the United States Telephone Company, of Cleve-

land, O., which company is building first-class long-distance toll lines to connect all of the independent telephone exchanges in Ohio, I have had occasion during the past few months to try to ascertain the statistics relating to the independent exchanges and toll line systems built and building in my own state. It has been almost impossible to get them, even with most careful observation. Exchanges are built and put into operation in small towns and connected with the outside world before their neighbors in adjacent counties are aware of the fact. Toll lines are building, and like the Kansas pumpkin vine, in one night grow so far that the end can not be found next day. From this experience and considering the shortness of time allowed for the preparation of this paper, I knew that anything like an attempt to secure statistical information, would be utterly useless and necessarily a failure. Therefore, what I may say on the subject of development will necessarily be fragmentary and of a general character, and contain a suggestion as to the wisdom of attempting to secure through the influence of this association and the records which it may establish more complete and accurate information for the future.

Those intimately connected with the independent telephone movement who read the various electrical journals and newspapers generally, get some glimpse of the development of the independent telephone business from paragraphs or items like the following: (Mr. Critchfield then quoted a large number of items such as appear in our telephone news each week and cited the figure of 3000 independent exchanges from the New York *Sun*.)

It is altogether probable that the statement credited to the New York *Sun* is not too high. It is corroborated by the information given by the Indianapolis *Sentinel* that there are more than 150 independent exchanges in the Hoosier State. There are about the same number in Ohio, and some fifty more exchanges in that State are now in different stages of promotion and completion. It is certain that pretty much every city and town in the Buckeye State will have an independent telephone exchange with ample long distance connections within the ensuing year. The Bell Company in Ohio, represented by about a half dozen subordinate or licensee companies, has not 100 exchanges in that state.

The independents, where they have completed exchanges in Ohio, are operating more than 21,000 telephones, as compared with but little more than 4000 used by the Bell Company and its licensees in the same towns and counties, and their toll service is almost proportionately larger than the Bell Company's.

This growth has also come notwithstanding the claims of the opposition company that the independents could not make good telephones and switchboards and could not operate them successfully even if they had first-class apparatus. These claims of the opposition company have proven untrue. There are to-day in this country, as you all know, many manufacturing concerns turning out apparatus for the independent telephone users which is equal in every respect to that turned out by the manufacturers for the American Bell. No better evidence of this fact is needed than is shown by the figures of the number of telephones used by the old and new companies in the same territory.

It has been my good fortune within the last few days to visit St. Louis and Indianapolis, and, at a more remote period, Detroit, Grand Rapids, Knoxville, Sioux City, Fort Wayne, Sandusky and numerous other large cities in which independent telephone exchanges are now in successful operation in competition with the Bell Company. In every single instance the independents have more telephones than the old company and in a number of them three times as many. These exchanges represent the apparatus of many different manufacturers, and are working against the most severe and active opposition. These exchanges are giving most satisfactory service, and in one of the cities referred to the largest single switchboard now in operation in the United States is daily answering more calls per drop than any other switchboard in North America.

The independent telephone movement acquired its first great impetus in the Middle Western States. The greatest development has, up to this time, taken place in those States, notably Iowa, Wisconsin, Michigan, Missouri, Illinois, Indiana and Ohio, while Pennsylvania, Kentucky, West Virginia, Minnesota, Kansas, Nebraska and the Dakotas have followed but shortly in the rear. But within the past two years especially the movement has extended until it embraces all sections of the country, and to-day, from Portland, to Atlanta, from Boston to San Francisco, from Minneapolis to Galveston and all the intervening country, independent exchanges and toll lines are building, new money and new brains are becoming interested, new patrons are served, and new fields developed. This is not idle talk as the following will illustrate: On the Pacific coast Portland, Olympia and San Francisco are building. Minneapolis and St. Paul are building. New Orleans, Galveston and Austin are in different stages of completion. Memphis and Atlanta have recently organized strong companies which will prosecute the work to a successful finish at a very early day. I am informed that contracts for the Pittsburg switchboard and telephones have been let; Baltimore and Boston, the latter the home of the American Bell Telephone Company, are building; and Philadelphia and New York will begin actual construction within the next sixty days. Cleveland will give service to more than 6000 telephones before the close of the present year. More than 200 men are at work on the subway in Columbus, O., which will be in full service within eight months. Dayton and Springfield, Portsmouth and Marietta are at it. Indianapolis, St. Louis, Grand Rapids, Detroit, Dubuque, Sioux City, Cedar Rapids, Fort Wayne are among the larger towns and cities which are now giving cheaper and better telephone service through independent plants than has ever yet been given by the old company.

That the business has been safely and profitably conducted is proven by the fact that there have been fewer failures of independent telephone companies in the United States since they came into existence than there have been of national banks. A showing which no other business with such phenomenal growth has ever made.

In almost every state in the Union, most notably perhaps in the Middle West before referred to, strong combinations are being formed with the sole purpose of building first-class toll lines within their respective states and with an understanding or arrangement for interchange of business with like companies in adjacent states. This work has already progressed until many thousands of miles of this kind of construction is now built, connecting the local exchanges and toll line systems with the outside world, and the work is rapidly progressing.

Another phase of the situation which has been briefly referred to is the character of construction. The growth toward better apparatus and better construction has been large, especially in the last two years. The time was when independent companies built carelessly, giving little attention to excellence in construction or superiority of apparatus. Other papers have given you valuable information in this department. I find from listening to the statements of those connected with the larger new companies and of those who have been longest in the independent field as well as from personal observation that very radical improvements have been made of late in the character of construction and results attained. Brains, inventive genius, have found a field among the independents and the patent office has shown greater activity in this department of electrical inventions during the past four years than in all the preceding twenty years. Manufacturers are striving in every way to better the apparatus turned out by them.

Operators are not slow to avail themselves of these improvements. Builders are using the best and looking for better. The consequent result is that a service is now being furnished, especially by the more recently constructed properties, that has not heretofore been equaled by either the old or the new companies, but I must hasten.

In my own state a very important development has begun among the farmers. It is true that many of the small towns and villages are now successfully supporting telephone exchanges, and the farmers in the adjacent rural districts are getting service at a price within their means and are insisting upon telephone faciltities. Thousands are already connected with exchanges, and tens of thousands more are applying for service in the more thickly settled agricultural regions of our country.

Heretofore the growth has been, one might say, sporadic. Indeed, one could almost compare the exchanges scattered here and there, to the appearance of a dry pavement, when at the beginning of a thunder storm you see the great spatters of water as the big drops fall, and then as they come faster the spatters run together until the whole is covered. In the Middle West this process of running together is already well developed. In some other portions of the country the shower has just begun, but will thicken and run together until the whole country is as thoroughly developed as those sections in which the movement first originated.

It rests with us and with others who will be attracted to the association because of its usefulness, actual and possible, to so com-

bine our efforts while maintaining our individuality and the benefit of local ownership and home control, to make of the independent telephone system a vast power for the benefit and advantage of the entire country.

Mr. Maxime Reber's paper on the "Essentials of Telephone Construction" did not aim to bring any new features of work before the convention, but summarized the standard elements of construction and operation that are familiar to all telephone men and have been approved by all telephone experience. He recommended provision for growth in the exchange and board, a complete system of distribution, as much subway as possible, good pole lines, 97 per cent. hard drawn copper, free use of aerial cable, rubber covered wire in buildings, careful selection of a central location for the exchange, very careful detailed specifications and instructions, the purchase of a complete system from one good manufacturer, inspection at point of manufacture, heating coils and carbon plates for lightning protection. The paper sums up for ready reference the standard of work in the independent field as exemplified by any good exchange at the present time.

In the evening a large party of the members, accompanied by the supply men, made a visit to the new summer resort, "Sans Souci" Park.

WEDNESDAY, JUNE 28.

The morning of the last day was devoted to exhibits and to private matters by the members of the association. Parties visited the various displays prepared in the halls and rooms at the Auditorium, about the headquarters and made trips to the principal factories and stores of the manufacturers and supply men. Considerable business was transacted.

Close to noon a most promising day was ruined by a heavy rainstorm which came up suddenly and left nothing but dark skies and wet streets behind it. In spite of threatening clouds, however, the original programme for a ride and drive was carried out. As soon as the rain stopped six tallyho coaches were filled by the telephone men, and a start was made for the parks. Owing to the risk of more rain, only a limited drive was taken down Michigan boulevard and through the south parks, a stop being made at the Field Columbian Museum. The trip back was made by boat, ending at the lake front near the Auditorium in time for the banquet.

The banquet was held in the banquet hall of the Auditorium, and was tendered by the supply men. Covers were laid for 250 guests. Hugh Dougherty, of Bluffton, Ind., was toastmaster. The menu cards were handsomely printed, and bore the following warning to the speakers and assurance to the listeners: "Rates to speakers: Five minutes free; each additional minute, $1." The list of speakers and toasts, which was adhered to rigorously, was as follows: Charles F. Flowers, Detroit, on "The Independent Telephone Men—Their Relation to Each Other;" Louis D. Passano, Pittsburg, on "The Commercial Value of the Telephone;" T. J. Fricker, Ashtabula, O., on "Sans Souci;" J. B. Ware, Grand Rapids, on "Our Friends; the Enemy;" I. A. Lumpkin, Mattoon, on "The Country Messenger;" J. B. Hoge, Cleveland, on "The Future of the Independent Movement;" G. W. Bandy, Perry, Ia., on "Constant Contact;" J. C. Harper, Madison, Wis., on "No Cross Talk;" Dwight E. Sapp, Mount Vernon, O., on "The Telephone Girl;" Judge L. J. Hackney, Indianapolis, on "The Patrons." There were musical numbers between the toasts.

Hon. Charles Flower, of Detroit, Mich., reviewed the early history of the independent telephone movement when the men who were seated at the banquet table entered the field against an enemy which he said was equipped with the advantages of long experience, wealth and cunning. Mr. Flower then alluded to the efforts that they had made to secure a foothold in the outlying districts, and said that the large centres of population, the cities, were now within the reach of the independent telephone men. He declared that the movement should not stop until the cities of Boston, New York, Philadelphia and Chicago were included in the circuit of the anti-Bell telephone companies, and a continuous line of their telephones reached across the continent from Washington to Chicago.

Louis D. Passano, of Detroit, gave a brief description in his address of the commercial value of the telephone. His conclusions were popular and of interest. The rest of the programme was as given above.

With the ending of the banquet the convention broke up. Many of the members left Chicago on the late night trains Wednesday, and the rest practically all departed the next morning.

On page 62 will be found a list of the names of those in attendance and a description of the exhibits and other features.

Electrical Notes in China—IV.

BY PROF. F. B. CROCKER.

IN my previous article, I made reference to the work of education in China, prefacing my remarks with the statement that electrical education did not exist. I noted the fact that beyond the ordinary education of the masses, there are three collegiate or university degrees which are given to those who are able to pass successfully the special examinations held for the purpose.

The first of these degrees, called Siu-tsai, and meaning "flowering talent," is somewhat equivalent to our B. A. The candidate must undergo three examinations, the first being held in the local districts, the second in the chief town of the department and the third in the capital of the province. The percentage of successful ones who finally graduate is small. The second degree is known as Ku-jin (variously spelt), signifiying "promoted men" and corresponding to our M. A., for which examinations are held triennially in the provincial capitals before two Imperial Commissioners, being simultaneous in all the eighteen provinces. Many of the candidates are of middle age, and some are sixty or seventy years old, the average age being over thirty. Cases have occurred where father, son and grandson have competed at the same examination. The number of students is very large since all of the siu-tsai or holders of the first degree in the entire province are included. At Canton, the capital of the province of Kwang-tung, having an estimated population of thirty million, I visited the "Examination Hall." This expression hardly gives one a correct idea, as it is really a very large enclosed space about 1400 by 650 feet divided into two sections, for officials and candidates respectively. The accommodations for the latter consist of a great many rows of cells on either side of a wide avenue, arranged as shown in the photograph which accompanied my previous article. Each cell is 5½ by 3½ feet, the total number being 11,616. In these the candidates are individually confined at daylight, the same texts being given to all upon which original essays must be written and handed in by the *following morning*. Careful watch is kept by the authorities to prevent intercommunication. The examinations occupy three sessions of three days each. Out of the many thousands who subject themselves to this ordeal only about one hundred obtain the degree. These are then eligible to go to Peking to attempt the third or doctor's degree, for which the procedure is similar, but the examiners are of higher rank. In this third trial only about two or three hundred of the candidates from the whole empire finally succeed, and enjoy the honor of being introduced to the Emperor, provided the Dowager Empress is willing and has not poisoned him beforehand.

From among the graduates or survivors of this process various civil offices are filled, such as that of magistrate, etc. But many of the holders of degrees never secure any official position, owing to favoritism, the possibility of purchasing degrees and other "ways that are dark" for which the "heathen Chinee" is justly celebrated.

The grumbler at our own civil service examinations should find consolation here. This very elaborate system of education is most interesting on account of its completeness and antiquity, but it only serves to hold the Chinese mind firmly fixed in the extremely narrow channel that it has followed for tens of centuries. European universities have always given special prominence to literary and classical studies, and it is right that they should continue to give them a considerable share of attention. Scientific and technical men are far too much inclined to neglect them. But scholars for hundreds of years, in fact, during Greek and Roman times, have also studied philosophy, theology, history, mathematics, natural history, and have quite clearly separated these subjects from one another. The Chinese jumble them all together. A play upon words or fallacy of the kind that Socrates laid bare, and which to-day would not deceive an American school boy, is considered to show great talent in a Chinese essay. Contemplate the gulf between this antediluvian education and the modern scientific training! Even if China were willing to advance it would take a very long time to pass from one extreme to the other. The Japanese Imperial University would be a very creditable institution in any country, as I have stated in previous letters, because Japan is eager to progress. On the other hand China is determined not to progress, and nothing but force, externally applied, will make her change in any way. The Chinese in New York and San Francisco are exactly the same as they are in Canton and Amoy. The Imperial Government will never adopt any reforms until it is forced to do so. A "concert of powers" is usually a very discordant performance, but, perhaps, the

combined influence of England, United States and Japan, whose interests are similar, might accomplish something. Otherwise the matter will be settled by the gradual absorption of China by various nations, or "the extension of their spheres of influence," which amounts to the same thing. My excuses for dwelling on this topic are its importance to American manufacturers and the fact that generally it has been given little attention by them.

The Brooklyn Electrical Supply System for Lighting and Power*—II.

DISTRIBUTION.

Distribution from a high tension multiphase plant is an important problem, particularly as regards the underground and overhead conductor systems. In Brooklyn, with a view of securing the best service on feeders, which must necessarily be overhead, heavy chestnut poles of about forty-five to fifty feet in height, and about ninety feet apart, were used. The poles are fitted with special six-pin cross-arms. On the outside insulators of the top cross-arm are attached barbed galvanized iron wires, which are grounded at every fourth pole. The second cross-arm carries the feeders in duplicate, three on each side of the pole. With three conductors on a horizontal cross-arm, inductive effects were reduced by transpositions, which, at low frequency, are satisfactory. The insulators are of glass, of the double or triple petticoat type, and during the two years they have been in use, no defects whatever have developed. The line is carried entirely over all obstructions, in some cases it being necessary to use seventy-foot poles. More or less trouble has been experienced with lightning, and the heaviest trunk lines have been equipped with lightning arresters.

In considering the question of an underground system for high tension work, three important points arise: First, the style of conduit; second, the style of the insulation of the cable; and third, the mechanical protection of the cable.

The style of conduit used in Brooklyn may be termed a closed system, owing to the fact that it has been the endeavor to keep the entire conduit system as water-tight and dry as possible. A vitrified tile duct is used, with water-tight joints, and the brick manholes are of double construction, filled in with tar, and built on heavy concrete foundations resting upon creosoted timbers. The covers of the manholes are patterned after the Edison ten-stub junction-box top. The inside cover is provided with a rubber gasket, and held in place by bolts. The outside is simply a heavy cover, acting as a mechanical protection to the inside one. The conduit system is connected to the unused brick stacks of the stations in which steam has been removed and transforming apparatus substituted. In addition, a blower is operated at the Bay Ridge station. The movement of air through such a large system, composed of some 100 miles of duct, is very slow, and yet it is sufficient to keep the system in good condition.

The reason for the adoption of a tile conduit as moisture proof as possible was in the main on account of electrolysis. In making preliminary tests along the proposed line of conduit it was found that the pressure from metallic substances to ground varied from ten volts negative to twenty-six volts positive. Thus it would only be a question of time before the heaviest lead cover would be totally destroyed. It was also found that the only solution was to make the lead cover of the cable negative to ground throughout the entire system. This demanded that all stray currents should always flow to the lead cover and should never leave it. Such a condition required that the lead covering of all the cables should be connected to the negative bus-bars of the railroad power houses by insulated conductors of low resistance.

The materials for insulation of conductors seem to have narrowed down to two in number, paper and rubber, and in conjunction with these might be considered the arrangement of conductors themselves. Three methods of arranging conductors for three-phase work are in use up to the present time: First, concentric cables; second, three-conductor twisted or "clover-leaf" cable; third, three distinct and separate conductors. Each of the above arrangements has its own particular value, depending on local conditions and requirements. All concentric cables should have the outside conductor grounded, to protect them from the increased pressure due to their arrangement. It is a very difficult form of conductor to handle, and is not of any particular advantage except in very high frequencies. The three-conductor twisted or "clover-leaf" cable is the arrangement generally provided for in all large installations, as on a frequency of sixty cycles, or under, the inductive effect is very small, and the arrangement of conductors gives a strength that is very necessary for the life of the cable. Separate conductors, separately insulated and drawn into different or the same ducts, can be used with a frequency of about twenty-five cycles without any noticeable effects from induction, and in many cases this arrangement is much preferred, as defects are easily repaired, and one extra conductor gives the advantage of a duplicate feeder as far as accidents are concerned.

Paper insulation, when made up with a liquid compound and of sufficient thickness, and when carefully laid, possesses some advantages, especially when such a cable can be laid for all time and need not be withdrawn and laid in other locations. Almost all defects in paper cable develop at bends; but if such bends are carefully made and the cable carefully handled in the laying, it is as satisfactory and lasting as any insulation in the market, as it is composed of material that is naturally homogeneous in its "make-up." Rubber insulation, unless properly specified, is somewhat uncertain, as the term "rubber" has come to include a variety of compounds which, although insulators momentarily, become fair conductors after short use. In almost all cases of large installations engineers prefer to specify, besides the quality of insulation, the thickness of the same, as this thickness has much to do with the life of the cable. Up to within a short time ago it was sufficient to test cables with fifty per cent. higher voltage than that which they were expected to carry, the test being made by placing the cable in a tub of water.

In polyphase work, and especially in large installations, many phenomena occur which require that the specifications should be more rigid. Resonance and induction under certain conditions produce effects that for an instant more than double the pressure on the system, such high pressure occurring at different points or nodes, and in no way affecting the ordinary operation of the system. This was ascertained in Brooklyn by the placing of spark gaps set for 12,000 volts at predetermined points on the system. In the event of sudden grounding of an outside conductor on an overhead line, the current invariably jumped the spark gaps at these points, although no effect was noticeable on the working system, the pressure at the generating and substations remaining steadily at 6,000 volts. There also exists the possibility of some careless attendant in some unusual excitement throwing in multiple two generators which are not in exact phase, this resulting in a sudden increased pressure. The adjustment of the power factor in a distant substation will even cause these waves to appear and pressure to be built up at certain points without seriously affecting the instruments at the stations. In order, therefore, to provide for all such emergencies, no cable should be purchased or installed unless it will stand for one hour at least double the working pressure, this being equivalent to a puncture test of more than three times the working pressure.

A cable ordinarily made up provides for half the insulation between ground and conductor as between conductors themselves. This, under perfect conditions of operation, should be sufficient, but when practical experience is referred to it is often found, where overhead conductors are employed, that one conductor of the system may become temporarily and accidentally grounded, in which case the same pressure with half the insulation exists between ground and conductor as between the conductors themselves. In order to more evenly distribute the strain of the cable, "split" insulation has often been used. This arrangement provides for an insulation around each conductor itself, and an insulation around all three conductors when made up and before the lead covering is put on, thus making the insulation between the lead covering and any one conductor the same as that between any two conductors. The thickness of the insulation itself will depend entirely upon the lasting quality of the insulator rather than on the ohmic resistance of such insulator. In other words, an insulator with low ohmic resistance may be preferable to an insulator with high ohmic resistance if its quality is more lasting. Cables with very high insulation have been known to break down suddenly, while cables with a low insulation have been known to last indefinitely.

*Abstract of a paper read by Mr. W. S. Barstow at the recent convention of the National Electric Light Association.

CURRENT NEWS AND NOTES.

THE MANILA CABLE.—The cable ship "Hooker," which sailed from New York on May 1 with 202 miles of submarine cable and a large telegraph equipment for the Philippine Islands, arrived at Manila on June 26. The ship was in charge of Lieut. Col. J. E. Maxfield. A full description of the "Hooker" and her mission was published in THE ELECTRICAL WORLD AND ENGINEER, May 16 last.

AN ACCIDENT TO MR. MARCONI.—Telegrams from Boulogne announce that while Mr. Marconi was recently driving from Boulogne to Wimereux the horse of his carriage bolted, and in jumping from the vehicle the inventor did some injury to his knee. The accident is not a serious one, however, although Mr. Marconi personally will probably be prevented from continuing his experiments for a few weeks.

A BIG ELECTRIC RUN.—With a Jeantaud automobile, Comte de Chasselouf-Loubat made on July 2 the longest run ever accomplished by an electric carriage on one charge of the accumulators. The trip was from Paris to Rouen and back, making 136 kilometres, or about 85 miles each way. The time was 7 hours and 15 minutes going. The batteries were recharged at Rouen, and the return trip made on that storing in 7½ hours.

NEXT FOURTH IN PARIS.—The next Fourth of July is to be American day at the Paris Exposition. Prof. Woodward, Assistant Commissioner, stated at the banquet in Paris this week, that President McKinley is to press a button here which, with the help of the cable, will release mechanism in Paris and unfurl the biggest Stars and Stripes ever made. This action will take place here at 7 a. m., making it high noon in Paris.

TROLLEY CARS IN DISFAVOR IN KOREA.—Since the introduction of trolley cars into Korea, says a special despatch several children have been run over and killed in Seoul. The people, to the number of several hundred, burned one car and smashed another. The Japanese and European engineers narrowly escaped death. The ignorant people attributed the drought which has continued for some time to the construction of the electric railways. The chief rioters have since then been executed.

THE NEEDS OF PORTO RICO.—The Merchants' Association of New York has just published in pamphlet form the report of Mr. Wm. R. Corwine, who was delegated to visit Porto Rico for the purpose of making an investigation of its general conditions from a commercial standpoint. The report is an extremely interesting one. Mr. Corwine dwells upon the existing conditions in that island, climatic, agricultural and commercial, and points out the manner in which the trade relations may be improved.

NO AUTOMOBILES IN CENTRAL PARK.—President Clausen of the New York Park Board, said on June 29 that he had received an application from a man who desired to run an automobile in Central Park. The request had been refused, as it was not thought proper to use the Park for such a vehicle, which might frighten horses and otherwise be a disfigurement or annoyance. Mr. Clausen would not divulge the name of the man who had made the application, but he is said to be a member of the Automobile Club.

ELECTRIC POWER ON ERIE CANAL.—Superintendent Partridge, of the State Department of Public Works, has granted the application of the Hudson River Power Transmission Company for permission to erect poles and string wires on the berme bank of the canal between Mechanicville and Albany, a distance of twenty miles. The plant of the company is located on the Hudson River, a big dam having been erected above Mechanicville through which the electric power is generated. The company desires to furnish electricity for lighting and power purposes. Gen. Francis V. Greene, of New York City, the president of the corporation, is also chairman of the Advisory Canal Committee appointed by Gov. Roosevelt.

BREAKING LAMP GLOBES.—In reviewing the public lighting in New York City for the last year, Commissioner Kearney comments on the destruction of the globes. "The malicious and wilful breakage of glass in the public lamps of the city is carried on to a very serious extent," the report says, "for 139,115 lights of glass and 1200 globes were broken during the past year. Lamplighters have found lamps broken when extinguishing the lamps, reglaze them during the day, and found the same lamps broken at lighting time. Of course, under this condition of affairs, the gas lights are extinguished by the winds, and then complaints are received because the lamps are not lighted, thereby causing us serious annoyance, and this bureau has no power to remedy the matter."

THE NATIONAL EXPORT EXPOSITION.—The Department of Publicity and Promotion of the National Export Exposition which will be held in Philadelphia from Sept. 14 to Nov. 30 this year has issued a pamphlet setting forth the objects, location, etc., of the enterprise. This exposition will be held under the auspices of the Philadelphia Commercial Museum and the Franklin Institute, its object being to promote the advancement of American manufactures and the extension of export trade. The exposition will be held under the authority of Congress and is endorsed by the principal chambers of commerce, boards of trade and other commercial organizations representing every State in the Union, which are giving active support and encouragement to the enterprise.

AN ENGLISH TELEPHONE DECISION.—A decision has been rendered in the English High Court of Chancery which obliges the National Telephone Company to obtain the consent of the road authority and any other people responsible for the maintenance of the roads, before laying any underground mains. In Bristol it recently laid some mains in a street which the Bristol Tramways Company is obliged to keep in repair. The Tramways Company is, however, as a matter of fact only obliged to keep in repair a certain width of the road within a certain distance of its rails, and it was decided that the Telephone Company was not bound to obtain its permission, as the tramways had not *locus standi* on the whole breadth of the thoroughfare. The distinction appears to be very fine, and it is expected that the matter will be brought before the Court of Appeals.

WIRELESS TELEGRAPHY IN ENGLAND.—A special cable despatch of July 1 from London says: The success of Marconi's wireless telegraphy has had the expected result of bringing a great number of imitators. The latest of these is Mr. S. H. Smith, who has proposed to the Postmaster General a scheme to connect the Channel Islands with the south coast of England telegraphically and telephonically on the wireless principle. Smith's system for improving Marconi's is an arrangement of a better transmitter, a more sensitive receiver and an instrument for fixing the sound of the waves so that they can be picked up only by one receiver, and are thus incapable of being intercepted. He also claims to be able to dispense entirely with high vertical wires. Mr. H. Jameson Davis, managing director of the Wireless Telegraphic Company, which owns Marconi's patents, says that he had knowledge of Smith's so-called improvements, but they could not be regarded as at all feasible.

DETROIT MUNICIPAL OWNERSHIP.—The plans of Gov Pingree and his associates for municipal ownership and operation of Detroit street railways received a serious setback at the hands of the Common Council on June 27. The two pending ordinances and other matter appertaining to the municipal ownership scheme were laid on the table by unanimous votes, and it is problematical when these questions will be again publicly debated. The Joint Committee on Streets and Ordinances, which had in charge the petition of the Street Railway Comissioners for calling a special election to determine the sentiment of the people as to corporation ownership by the commission in the city's behalf, submitted a report. The committee found that no bargain could be made with the railways if three-cent instead of five-cent fares were inserted in the security franchise, and, considering the lack of legal authority for proceeding to a special election, the litigation and the other contingencies, the committee unanimously declined to recommend any steps toward city ownership at this time. The committee's report was unanimously accepted and the ordinances tabled, thus ending the entire matter, for the present at least.

ENGLISH MUNICIPAL ELECTRICAL ASSOCIATION.—This association, which is fast increasing in size and has already assumed considerable importance in the electrical industry in Great Britain owing to the number of supply stations owned by local authorities, held its fourth annual convention in Bristol last month. One of the papers submitted raised the interesting question whether the profits (if there be any) derived from municipal electric lighting stations should be devoted to relieving the tax rate or to reducing the price charged for current. That is to say, should the general body of taxpayers or the consumers benefit by the profit made out of the latter? The fair answer to the questions seems evidently that the consumers only should benefit, but many contented that as it is the taxpayers' money which is invested in the undertaking, and as any losses have to be paid from the taxes, any profits that arise should be devoted to the reduction of taxes. It is stipulated in the provisional orders granted to municipal bodies that not more than a profit of 5 per cent. may be allotted in this manner. In a discussion on a paper on "Combined Lighting and Traction Work," Mr. Rider and a great many other speakers, including Mr. Ferranti and Mr. Wordingham (the borough electrical engineer at Manchester) were in favor of combining lighting and traction plants in one single station, however large the supply area and the demand might be, and advocated on large systems the arrangement more recently adopted in America of erecting one large station at a point where land, coal and condensing water are cheap, and distributing from there at high pressure to transformer stations at central points in the town. Mr. Chamen, on the other hand, advocated the multiplication of generating stations in a large town such as Glasgow (of which he is borough electric lighting engineer), although he thought that such stations might perhaps be designed to take both traction and lighting load. Mr. Barnard, of Hull, pointed out that it was not always good practice to enlarge an electric lighting station which had been built some years ago in order to render it capable of taking up the supply of electrical energy for both purposes. In the discussion of a paper on "Steam Pipe Fittings and their Arrangements," both Mr. Ferranti and Mr. Chamen severely criticised the complexity which has gradually been introduced into the arrangement of steam pipes in central stations. Mr. Ferranti compared them to switchboards for, he pointed out, it was often the designers' endeavor to make most ingenious but unnecessary arrangements by a number of valves and a great length of pipe for all sorts of cross connections between engines and boilers, from which very little advantage was gained. Opinion was expressed by several speakers against the use of the steam ring main, and simple duplicate steam mains were recommended by the majority. This opinion, it may be added, is concurred in by many American engineers. The convention took place from June 14 to 17 under the Presidency of Mr. H. Faraday Proctor, borough electrical engineer at Bristol. The meeting place for next year has been fixed for Huddersfield, and Mr. A. B. Mountain, borough electrical engineer at that town, will be president.

EXPORTS OF ELECTRICAL MATERIAL FROM NEW YORK.—The following exports of electrical material are from the port of New York for the week ending June 27: Antwerp, 10 packages electrical material $925; Argentine Republic, 25 cases electrical machinery $2588, 71 cases electrical material $2053; Brazil, 90 cases electrical material $2840; British Guiana, 7 cases electrical material $145; Bristol, 1 case electrical material $127; British West Indies, 89 packages electrical material $3635; Chili, 11 cases electrical material $60; Central America, 14 packages electrical material $251, 20 cases electrical material $2840; Dublin, 92 packages electrical material $113; Glasgow, 8 packages electrical material $179; Genoa, 37 cases electrical material $3600; Havre, 12 packages electrical material $1675, 19 cases electrical machinery $691; Hamburg, 150 packages electrical machinery $3600, 98 packages electrical material $5543; Liverpool, 12 cases electrical material $518; London, 65 cases electrical material $2240, 27 packages electrical material $1762; Mexico, 24 cases electrical material $197; Madrid, 1 case electrical material $53; Peru, 27 cases electrical material $2486; Porto Rico, 26 packages electrical material $71; Rotterdam, 3 cases electrical material $45; Santo Domingo, 3 cases electrical material $45; Sandwich Islands, 17 cases electrical material $80; Southampton, 2 cases electrical material $18, 21 packages electrical machinery $1140, 1 electrical whistle $350; Uruguay, 2 cases electrical material $64; U. S. of Colombia, 43 packages electrical material $895; Venezuela, 2 cases electrical material $45.

LETTERS TO THE EDITORS.

The Telephone Relay.

To the Editors of Electrical World and Engineer:

Sirs:—Something more than ten years ago I participated in a series of experiments made in an endeavor to develop a practical telephone repeater. Apparatus was constructed, under the direction of Mr. Pickernell, of New York, and Mr. Hayes, of Boston, by means of which repeating and relaying was accomplished from one line to another, but after a great many tests it was thought that the results were not reliable enough to warrant the introduction of the apparatus on commercial lines. These and other experiments emphasized the fact which had been previously developed, that any gain in the volume of tone involved a loss in the clearness of articulation. This result has always been noticed when attempts have been made to perfect the so-called loud-speaking telephone. I should not care to say that a perfect telephonic repeater is impossible, but I think there is to-day a vitally important missing link which must be discovered before the problem can be practically solved.

ANGUS S. HIBBARD.

CHICAGO, ILL.

To the Editors of Electrical World and Engineer:

Sirs:—I am glad to give you, as requested, my opinion on Mr. Glidden's offer for a perfect telephone, though I consider that your editorial on the subject covers the main points at issue. Sound being the result of energy of air vibrations and time, you cannot change one factor without affecting the other and without producing a different sound. The word microphone itself is a misnomer, because the apparatus never increased the loudness of a sound, but only brings it closer to the ear or also adds impure noises to it.

In a telephone relay you might, by the use of a diaphragm of a slow rate of vibration, give greater amplitude to a set of sound waves and use the momentum of the diaphragm to impress itself on the fresh current of the relay primary, but you would lose some of the overtones and eventually make the voice unrecognizable. The energy of the overtones would be transformed into increasing the extent of vibrations of the fundamental; this, I believe, has been the case with the best telephone relays so far constructed.

In a telegraph relay the time factor is of little importance, and when once a firm contact has been made, it is maintained long enough to permit additional energy to enter the new circuit. It would evidently take a more sensitive controlling device than a loose contact of a more effective electromagnetic apparatus than the Bell telephone to transform without change a weak voice current into a stronger one.

E. BERLINER.

WASHINGTON, D. C.

To the Editors of Electrical World and Engineer:

Sirs:—The largeness of Mr. Glidden's offer for a practical telephone repeater is the best proof of the difficulties in the way of making one. It is not worth while to discuss in an electrical journal the differences between a telegraph repeater and the requirements of a voice repeater. Two hundred words per minute or 50 impulses per second can be repeated telegraphically; about 1500 impulses per second would be required for telephony, the maximum of one being the minimum of the other. The telegraph may use horse-power in mechanically putting the impulses on the line and all the current that is good for transmission. The telephone transmitter is limited to the moving power of the voice, and the current power is correspondingly restricted.

I do not think the extension of speaking distance will come by intermediate automatic repetition, but through improvements in the means and medium of direct communication. I would suggest that Mr. Glidden widen the scope of his tempting offer and include direct working over certain distances, placing a limit on the cost of line. Direct telephony like direct telegraphy would be, wherever practicable, preferable to repeater working, no matter how perfect the repeater might be. Should the telephone company stop at 1500 miles for speaking, they can keep on with their lines to San Francisco and telegraph 250 words per minute, plainly recorded, which is four times as many words as can be talked, even should a perfect

repeater or transmitter be found, and it seems to me this would insure against commercial failure. PATRICK B. DELANY.

SOUTH ORANGE, N. J.

Elevator Motors.

To the Editors of Electrical World and Engineer:

Sirs:—The electric motor has become a factor in business and is no longer considered a convenient but extravagant means of motive power. It is the constant-potential shunt motor which does the greatest share of the work performed. It fills the conditions of an ideal motor in cases where a constant speed is continuously required.

But there is another class, probably a more numerous one, which may be subdivided into motors which are to be run at intervals, as separate driven tools; and those which have to be stopped and started frequently as elevator motors.

As to the first class, a common starting box introducing ohmic resistance into the armature circuit is thought sufficient. In the case of the second-class, however, until lately it was thought sufficient to have a starting box controlled from the car of passenger elevators. The freight elevator, which has been sadly neglected, is a chapter by itself.

The item of current consumption in a building suitable for elevator service and for all cases where frequent starting and stopping is required, is a shunt motor provided with series coils so proportioned that they will act as resistance in the armature circuit, and strengthening the field at starting, being cut out as the armature comes up to speed.

It occurred to me that using Sayer's method of field excitation, placing a "third brush" between the other two and connecting the field between this "third" and one of the other, and allowing it to be moved through an arc having its centre in the armature shaft, one will be enabled to start a motor thus connected smoothly though fully loaded. To start, the "third brush" would be moved hard against the one not connected to the field, close to the main switch; the field having half the resistance that a common shunt would have, will admit a rush of current, thus giving it a strength great enough to start the motor with the necessary torque at full load even without sparking. Then the "third brush" is either by hand or automatically moved towards the other brush, until it reaches the middle, when the motor will be at full speed.

NEW YORK, N. Y. PAUL G. TISMER.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

DYNAMOS, MOTORS AND TRANSFORMERS.

Friction Losses in Dynamos.—DETTMAR.—The conclusion of his long article (see Digest, June 24). He develops various formulas for predetermining the friction losses and gives some practical data and the results of experiments; the formulas seem to be of a practical nature. The first is for a constant temperature of the bearing; in order to simplify the formula he uses a friction coefficient which applies to a certain specific pressure as this makes the coefficient dependent only on the surface speed; in this way the pressure on the bearing is eliminated from the formula and it is then possible to calculate the frictional losses from the dimensions of the bearing, always provided that the pressure is below 30 to 44-kg per sq.cm, which is always the case in dynamos. His concluding formula is as follows:

$$R = 49.05\ r\ d\ l\sqrt{w^3}$$

in which R is the frictional loss in watts, r a constant depending on the oil and the temperature, d the diameter in cm, l the length in cm, w the surface speed in meters per second. He also deduces a formula for any given temperature, which is considerably more complicated. It shows that the increase of temperature of a bearing depends chiefly on the surface speed, and that the length of the bearing does not affect it. The application of the formula can be simplified by the fact that for a certain surface speed there is a certain increase of temperature, and a curve may be drawn showing the temperature increase as a function of this speed; this is illustrated by an example. Up to the pressures above mentioned, the calculated loss will be the same for all loads, and will therefore be independent of the tension on the belt. For a temperature of 37.5° the value of r was calculated and found to be 0.01414. The results of tests are given showing that the air friction increases about as the 1.3rd. power of the speed. The brush friction is then discussed; a number of tests showed that this friction loss is not exactly proportional to the speed, but the deviation from proportionality is not great and is appreciable only for high speeds; proportionality may therefore be assumed. The results of his tests of brush friction, in which twelve brushes were connected in series, are given; the mean friction coefficient of copper gauze brushes on copper connectors is 0.3; for carbon brushes it is 0.227, but this depends somewhat on the hardness of the carbon. These formulas enable all the friction losses to be predetermined; a table gives the calculated and observed values showing quite good agreement. In conclusion he adds an example in the application of the formulas.—*Elek. Zeit.,* June 8.

LIGHTS AND LIGHTING.

Incandescent Lamp Protectors.—KAES.—An illustrated description of a device to be used in mines where there is danger of the ignition of fire damp. The object is to cut the lamp out of circuit in case the bulb is broken before the filament has time to ignite the fire damp. In turning on the lamp a spring switch is set, and the lamp is so mounted, hanging against a flexible diaphragm, that if the lamp should receive a jar it will release this spring switch, which cuts off the current. The whole device is also protected by a hemispherical glass globe.—*Zeit. f. Beleucht,* June 10.

Experiments With Enclosed Arcs.—Some experiments recently made by Gerard and Bast are briefly described in *L'Eclairage Elec.,* May 27. They show that in the enclosed arc the blackening of the interior globe diminishes the efficiency from 16 to 20 per cent., the former referring to the mean spherical intensity and the latter to the mean hemispherical below the horizon. The lamp required 108 volts and 4.5 amperes; the first series of tests was made with new carbons and the globes were perfectly clean, while the second was made after the lamp had been running 103 hours, the total life of a pair of carbons being 110 hours. The mean spherical luminous intensities were 168.8 and 129.5 decimal candles respectively, while the mean hemispherical intensities below the horizon were 199.8 and 157.6. The number of watts per decimal candle for the mean spherical intensity were 2.9 and 3.71 at the beginning and the end respectively; the watts consumed per decimal candle of the hemispherical intensity were 2.45 and 3.047 respectively. One Carcel was taken to be equal to 9.62 decimal candles.—*L'Eclairage Elec.,* May 27.

L'Ind. Elec., May 25, abstracts these figures more briefly and adds that the consumption per candle power shows that the enclosed arc has no advantage in efficiency over incandescent lamps of 3 watts per candle.

POWER.

Methods of Electrical Transformation.—SWINBURNE.—A reprint of a short paper read before the Institution of Civil Engineers, making some interesting comparisons of the different systems on various different bases. Whenever direct current is wanted, when the power is transmitted, the high voltage direct current generator requires reconsideration; when the alternating current is used in such cases a transformer of the motor-dynamo type will be necessary, thus diminishing the advantage of the alternating over the direct current system; the efficiency of the generators and of the whole system may be higher for the continuous current. Considering the question of copper only, the first question is what pressure is to be used; the next, whether that is the maximum, the effective or the mean; and the next, whether this is compared with the earth or with other parts of the circuits. He assumes that in all alternating current circuits the maximum pressure should be taken as being the critical pressure as regards insulation rupture, and the life. For comparison he takes

a set of definite cases assuming 10,000 volts and two square centimeters of copper at a density of 200 amperes per sq.cm. In case No. 1, the system is earthed at a middle point and no wire is to be more than 10,000 volts from earth; for the direct current the voltage then is 20,000 and the current 200 amp.; for the single alternating current it will be 7100 on each side; for the two-phase alternating current it is the same, but the thick wire is grounded and has less current; for the three-phase current the middle point is earthed and the voltage between the wires is more than 10,000. In case No. 2 one conductor is earthed, which practically means the concentric mains with little insulation on the outside wire; the direct current has 10,000 volts and 200 amperes; the single alternating, 7100 and 200; the two-phase current remains the same as before, but the three-phase comes down considerably. In case No. 3 the difference between no two conductors should exceed 10,000 volts. These are summarized in the following table giving the output in kilowatts for the various systems; in case No. 1: For the direct current 4000, single alternating 2824, double alternating 1650, triple alternating 5000. In case No. 2 these four figures are as follows, respectively: 2000, 1412, 1650 and 2824. In case No. 3 they are 2000, 1412, 1170 and 2824. In all these cases the three-phase current is best and the direct current second. In discussing the question of insulation he gives a formula based on the assumption that at no part of the dielectric must there be a stress exceeding 20,000 volts per centimeter; this formula is

$$log.\ R = \frac{E}{S\ r} + log.\ r.$$

in which R is the radius of insulation, E the pressure, S the maximum stress, and r the radius of the wire. This rule is true only for homogeneous dielectrics and is given only as an assumption, as cable makers in practice do not follow it. These figures are claimed to show broadly that the direct and single current alternators are preferable as far as the cost and convenience of insulation are concerned. In the case of the receiving transformers or converters, if direct current is required for distribution, there is not much to choose; if the alternating current is to be delivered, the single alternating system leads the others. Diagrams are given showing the thickness of the wire and that of the insulation in the various cases. In convenience in measurement and handling the direct current is far ahead; the capacity effects are more troublesome in multiphase work.—In the discussion which followed, Crompton considered the case No. 3 the most interesting to engineers, but he believes that Swinburne's treatment is very incomplete, the power factor is not taken into account and the results are therefore true for only non-inductive resistances such as are not found in practice. In a recent conversation with Mr. C. E. L. Brown, the latter said that German and Swiss experience proved that as far as copper was concerned, the three-phase and direct current systems were equal; as far as the conductors are concerned, bare copper gave no trouble except when exceedingly high pressures such as 40,000 volts were used; up to 20,000 he thought there was no waste of power from static discharges.—Lond. *Elec. Eng.*, June 9.

REFERENCES.

Long-Distance Transmission.—FORBES.—A note correcting some mistakes in table No. 3, in his article (see Digest, Dec. 24 and 31). The figures in the columns of current intensities with an efficiency of 1.3 were wrong.—Lond. *Elec. Rev.*, June 16.

TRACTION.

Earth Return Currents.—In the discussion of Kallmann's paper (see Digest, March 18), Wagner gave the results of a test in which two iron earth plates were buried about five meters from the uninsulated return of a railway line, which led the current from the rails to the central station; one of these plates was connected to the gas pipes and the second was connected to nothing; currents in the gas pipes could pass into that plate and then into the uninsulated cable. After a period of two years there was only a very slight loss in weight in the two plates, the loss of the connected plate being about twice as great as that of the disconnected one; this loss (presumably that of the connected plate) corresponds to 0.001 ampere, which is therefore insignificant and shows that in that particular kind of earth, which is sandy, there is no danger of corrosion. West described a way of measuring the conductivity of joints, which is noticed above in a separate abstract. Kallmann described a model consisting of a bare wire coil in a conducting liquid, by means of which the conditions existing in connection with railway currents can all be reproduced, and with which, for instance, the point at which there is the greatest leakage of the current can be determined. Gaisberg questioned whether it is right to allow the same earth current in the case in which the distance between the feeding points is great, as when it is small; in the latter case he thinks the allowable earth current should be less. Kallmann did not agree with him.—*Elek. Zeit.*, June 15.

Electric Traction.—CUNINGHAM.—A brief paper read before the Institution of Civil Engineers. He shows that in the electric system, the first cost of which is much greater than in traction by horses, the gain lies almost entirely in the greatly reduced cost of operation, and that in this the cost of the power is the chief item where much saving can be effected; it is therefore the power house which should receive the most careful consideration. He favors low speed compound condensing engines of about 70 revs., boilers of the Lancashire or Galloway type with Green's economizers. He constructed and operated such a plant at Montreal, where the cost of producing current was a little less than 0.5 cent per kw-hour and the cost per car mile less than one cent, during those portions of the year when coal could be obtained for $2.25 per ton; the coal consumption was 3.48 lb. per kw. hour or 2.60 per electrical hp.hour, the average for the whole year being only 2.75; the daily output of the station average 43,000 units. The whole cost of working, including working charges of all kinds, should be under 10 cents per car mile, but this is possible only with a carefully constructed power house.—In the discussion Mr. Hammond also thought slow speed engines gave a greater economy than those of high speed, comparing the plants at Leeds and Bradford with each other, for both of which the coal came from the same mines; in the former the cost of coal per unit was about half that at the latter, where high speed engines were used. Crompton stated that after experimenting a long time he had found that although the slow speed engine was more economical in coal, the extra cost of the oil wiped out the saving; a much more skilled attendant was required for the slow speed engine. Kennedy, referring to a recent tour in America, gave the following average results of the cost of working: The drivers', conductors' and inspectors' wages were about 42 per cent. of the total; the generating expenses 18 per cent.; the maintenance of the cars 12 per cent.; the maintenance of the line and equipment 12 per cent., and the general expenses 16 per cent. There were instances in which the cost of power was only 10 per cent. of the total. A saving could be looked for in the reduction of the cost of maintenance. Cuningham said that he had personally found in America that slow speed engines were more economical than high speed.—Lond. *Elec. Eng.*, June 9.

Projected Long-Distance Railroad.—A note stating that there is a project to construct a 180-mile railroad in Kashmir Valley in India, at an expense of $5,000,000. Owing to the scarcity of fuel and the abundance of water power, besides the steepness of the gradients, the use of electricity is favored.—Lond. *Elec. Rev.*, June 16.

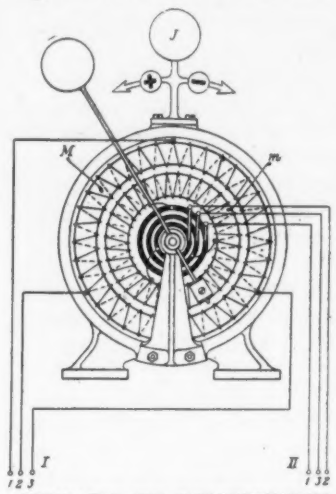
REFERENCES.

Transporting Wagons on Electric Railroads.—An illustrated description of the Bonner system, which is in use on a few lines near Toledo and is on trial at Detroit. Road wagons, ordinarily drawn by horses, are placed with their wheels just clear of the ground on to a low truck which is drawn on the rails by a motor car. They are drawn to the rail by horses, and after transportation over the railway, are again hauled by horses to their final destination. The carrying capacity of the wagons is from 3 to 7 tons; the truck alone weighs about 4000 pounds.—*Eng. News*, June 15.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Apparatus for Synchronizing Alternators.—MUELLER.—An illustrated description of an apparatus based on the use of two rotating magnetic fields; it not only shows whether two alternators are in phase, but also whether the unloaded machine which is to be connected in parallel with the other, is running too rapidly or too slowly. The arrangement is shown in the adjoining figure, and is intended for three-phase currents. The outside magnet M is stationary and the windings are connected to the bus bars, while the second or interior magnet m is capable of rotating and is in circuit with the alternator which is to be brought into phase with the currents in the bus bars. The connections are so made that the two rotating fields which are produced will revolve in the same direction, and there will then be no rotation of the movable part when the frequencies of the two currents are the same; but a torque will be produced when the frequencies are different and the rotation will then be in the same or the opposite direction to that of the induced fields, according as the frequency of alternator No. 2 is smaller than that of alternator

No. 1. A pointer with a signal dial is screwed to the movable part as shown; a deflection to the right or negative direction means that the speed of the alternator is too slow, and to the other side, too fast. The mechanical power developed by this apparatus is quite great and it can therefore also be used for operating a regulator. In a simpler and more effective modification, which is also illustrated, there are two such fields revolving in opposite directions over stationary cores, both of which act on a third ring magnet, also stationary, which operates the signal; the latter is accomplished by means of a row of incandescent lamps, connected to this ring winding, and which will then be illuminated in succession so as to give the appearance of a wave of light moving in one of the other direction around a circle. When the two frequencies are the same this wave of light will appear to stand still, but when the speeds are different the movement of the wave of light will show whether the frequency of the machine to be connected is too high or too low, the speed of the rotation being an indication of the difference between the frequencies. Synchronism, in addition to equality of frequency, will exist only when certain special lamps are illuminated, and the machines must therefore be coupled only when the slowly moving wave of light appears over those lamps; this position may be indicated by an additional colored lamp. The apparatus may be simplified by winding both coils on the same core, the incandescent lamps being connected to a winding on a separate core; it may also be possible to have all three windings on a single core.—*Elek. Zeit.*, June 15.



APPARATUS FOR SYNCHRONIZING ALTERNATORS.

Step-by-Step Resistances.—A simple method of increasing the number of steps in such adjustable resistances, without increasing the number of contact points and coils, is described by Mr. Guichot in *L'Elec.*, June 3. It consists simply in the use of one additional coil, the ends of which are moved by the lever arm and are so placed that they may be brought into contact with two successive contact blocks, in which case that additional coil will be in parallel with the other. In certain intermediate positions it is cut out of circuit entirely or short-circuited. It therefore enables an additional resistance to be obtained between each two of the successive steps, thus practically doubling the number of steps.—GUICHOT. *L'Elec.*, June 3.

WIRES, WIRING AND CONDUITS.

Application of the Vector Diagram for Long Lines.—The beginning of an article on the application of the vector diagram to show the propagation of alternating currents in long lines, and on the commercial limit of high voltages. In a former article (see Digest April 1, under Measurements of Telephone Circuits), the same author showed with measurements that in double lines or loops in which the wires lie next to each other, the propagation of the alternating currents agree completely with the theoretical laws. In the present article he compares the results of calculations for the lower frequencies usual in practice, with the results of observations. The graphical method which he describes is much simpler that the analytical one and is claimed to be quite correct, as it involves no quantities which are assumed to be neglected.—BREISIG. *Elek. Zeit.*, June 1.

Interrupter for Broken Wires.—A novel form of an automatic interrupter devised by Dusornot is described in *L'Eclairage Elec.*, May 27; the object is to electrically disconnect a wire from the source of current, when a broken end falls to the ground; it is intended to be applied to circuits crossing streets and roads and must be inserted at both ends which are to be protected. In principle, it consists in breaking the continuity of the wire, and securing the two ends a slight distance apart in a closed insulated tube which is partially filled with mercury; when the wire is horizontal the mercury touches both the ends of the wire and thus preserves the continuity of the circuit; but when the wire breaks, this interrupter will assume a more or less vertical position, in which case the mercury flows to one end of the tube, thus breaking the circuit.—*L'Eclairage Elec.*, May 27.

ELECTRO-PHYSICS AND MAGNETISM.

Radiations.—ABBOTT.—A brief abstract of a paper from the *Jour. West. Soc. of Eng.* The historical description is said to be especially good. Among other things, he stated that in order to bring the wave length of Hertzian waves down to that of light it will be necessary to have spheres of the size of the ultimate atom, the charges and discharges taking place between such spheres. A table is given in the original (but not in the abstract) for the wave lengths of different waves. That of the magnetic waves from the sun is given as 1.25 million miles, a complete vibration extends over 6.5 seconds. The wave length of a flash of lightning is given as 11,000 miles and 17 vibrations per second. That from a discharge of a pint Leyden jar is 34 ft., while a large oscillator produces a wave one foot long. The shortest electrical waves so far produced is said to be 2.5 inches, and if the wave length of red light is roughly three-millionths of an inch, there is a great gap between these two. The efficiency in wireless telegraphy is approximately one 500,000,000ths of 1 per cent. (this of course depends on the distance).—Lond. *Elec. Eng.*, June 9.

Variation of Resistivity with Torsion.—Mr. Szily made what appears to have been very careful investigations of the variation of the electric resistivity of a wire with torsion, the results of which are given in a French Academy paper abstracted in *L'Ind. Elec.*, May 10, and *L'Eclair. Elec.*, May 27. His experiments were made mostly with the alloy constantan. He found that the resistance increased with the angle of torsion and much more rapidly than in direct proportion; up to the limit of elasticity the increase may be considered proportional to the angle of torsion. The increase was quite small; for instance, for an angle of torsion of 10.2 H the increase was 0.00072, the original resistance being 10.6002 ohms. He also found that the resistance does not remain quite constant after torsion, but diminishes, although extremely slowly. The variation of the resistivity increases more rapidly than the diameter.—SZILY. *L'Ind. Elec.*, May 10.

Fluorescent Screens.—MOURELO.—Descriptions of experiments with a variety of solid solutions of manganese carbonate in strontium sulphide, in order to determine the best composition which gives the greatest intensity of fluorescence. This he found to be obtained with a mixture of strontium carbonate 100 grams; flour of sulphur, 33 grams; sodium carbonate, 1.4 grams, fused with soldium chloride 0.85 gram and manganese carbonate 0.15. The mixture is finely powdered, compressed and placed in an earthenware crucible in which it is kept at a red heat for three hours and then allowed to cool slowly. If exposed to daylight it shows a brilliant green fluorescence.—MOURELO. *Comptes Rendus*, May 15; abstracted briefly in Lond. *Elec.*, June 9.

Spectroscope Measurements of the Arc.—LEHMANN-RICHTER.—An abstract of a paper describing measurements. In the normal continuous current arc there are three sources which should be distinguished from each other; the aureol, which is generally green, the dark adjoining mantel of flame, and the bright, bluish-violet centre of the arc. He shows how the total radiation is made up of these three. The results leave no doubt that the radiation from the positive carbon is the same even when the amount of energy consumed is very different.—*Elek. Zeit.*, June 8.

Iron-Paraffin Dielectrics.—BOCCARA and PANDOLFI.—A study of what they call a dielectro-magnetic medium made of chemically pure iron powder intimately mixed with paraffin. The measurements of the inductive or dielectric constant were confined to mixtures in which the iron was less than 50 per cent. of the whole, for above that the material becomes conducting. They found that the conductivity increases more and more rapidly with the percentage of iron.—*Nuovo Cimento*, April; abstracted briefly in Lond. *Elec.*, June 9.

REFERENCES.

Coherer.—BLONDEL.—Illustrations of his form, in which there is a side pocket containing a supply of fresh filings, and the Lodge tube which was recently claimed to be an anticipation.—Lond. *Elec.*, June 16.

Moistened Coherers.—Descriptions of experiments to consider the action of electrical oscillations on moistened contacts of conductors. He found that the coherer phenomenon can, in general, not be produced with moistened filings.—ASCHKINASS. *Wied. Ann.*, 67, p. 842; abstracted in the *Elek. Zeit.*, May 25.

Ball Coherers.—A longer reprint of the Academy paper noticed in the Digest June 10.—BRANLY. *L'Elec.*, June 3.

Electric Waves.—A description of a new lecture room experiment.—COOLIDGE. *Wied. Ann.*, March; abstracted briefly in *L'Eclairage Elec.*, May 27.

Human Rays.—HOFMANN.—A short article on rays emitted by the human body, which act on photographic plates; they pass through certain opaque substances and impart their vibration to materials which then act on the photographic plate. Some photographic impressions are reproduced.—*Eng. and Min. Jour.*, June 24.

Distribution of Magnetic Induction in a Long Iron Bar.—LAMB.—A brief notice of a Physical Society paper describing experiments to determine the B-H curve of an iron bar whose length was two hundred and fifty times its diameter. The curves showing the variation of the permeability along the bar, were constructed.—Lond. *Elec.* and *Elec. Eng.*, June 16.

ELECTRO-CHEMISTRY AND BATTERIES.

Silicon and Copper Silicide.—STEINHARDT.—A short article giving the chief uses of metallic silicon and copper silicide, both of which are now being manufactured in considerable quantities in Germany by an electrical process, the details of which are still kept secret. The metallic silicon is used in making iron or steel castings. One of the uses of the copper silicide is to alloy it with copper for making wires which have a far greater strength than the ordinary copper wires. The tensile strength per sq.mm of pure copper is given as 28 to 35-kg, while with about 1 per cent. of Si and 1.1 per cent. of tin, it is 83, the conductivity being 100 and 43 respectively; a further increase greatly increases the tensile strength but at the expense of the electrical conductivity.—*Eng. and Min. Jour.*, June 17.

Disintegration of Metallic Cathodes.—In a recent paper by Bredig and Haber, the authors discuss the conditions under which cathodes are disintegrated and converted into dust during electrolysis. If the end of a clean lead wire forms the cathode in a very dilute solution of a mineral acid, the anode being platinum, a black cloud of finely divided lead dust will form around the end of the wire when high current densities are used; the ends of the wire afterwards will be found to be pitted. If the solution is potassium carbonate and a current of air and carbon dioxide are passed through it, white lead will be obtained as the product of the disintegration; one ampere hour at 10 volts produces one-quarter of a gram of white lead. The easily fusible metals like cadmium and zinc as well as those which fuse less readily, such as copper, silver, aluminum, platinum and palladium, do not show the phenomenon. No explanation seems to be offered.—BREDIG and HABER. *Ber. Dutschen Chem. Ges.*, Vol. 31, p. 2741; abstracted briefly in Lond. *Elec. Rev.*, May 26.

Electromotive Force and Decomposition.—A reply by Tommasi to some statements by Minet on the law of the proportionality of the lowest e. m. f. necessary to produce decomposition of an electrolyte, and the heat of formation of this electrolyte, is translated from a French paper in the Lond. *Elec. Rev.*, June 2. Tommasi considers that the following laws may be formulated: "1. When a body is subjected to two chemical actions, the one that will evolve the greater quantity of heat will always occur in preference, provided always that it can be initiated. 2. Of two chemical reactions, the one requiring the less quantity of heat or energy to initiate it will always preferably take place, even if it be attended with a less evolution of heat than the other reaction." He furthermore states that, from what has been set forth, it follows that "the principle of maximum work is entirely disproved, and it is, therefore, to be desired that it should be replaced by a new thermo-chemical principle more in accord with experience. This new principle, which it is now proposed to term the principle of least work, may be formulated as follows: "The chemical reaction which requires the least quantity of energy to initiate it, will always be preferably produced, whatever may be the quantity of heat which this reaction, once commenced, may evolve or absorb."—TOMMASI. Lond. *Elec. Rev.*, June 2.

Sterilization of Water by Ozone.—A reprint of an Academy note on their recent researches, which were intended to be on an industrial scale. The voltage of the secondary was 30,000; the apparatus was on the principles of the classic ozonizer of Berthelot, and was cooled with water. An examination by bacteriologists showed that all pathological microbes which were in the water they used, were completely destroyed except one, which is uninjurious to man and animal. Moreover this process does not introduce any foreign substance in the water, and the water thus treated is less subject to subsequent pollution.—MARMIER and ABRAHAM. *L'Elec.*, June 3.

In the issue of May 27 there is a reply by Abraham to the unfavorable discussion of their experiments by Andreoli which was noticed in the Digest May 27.

Sterilization of Water.—A note stating that Andreoli has improved his previous figures so that he can now sterilize one cubic meter of water, that is, 220 gallons, with 60 to 70 watt hours, that is, at the rate of 3,000 gallons per kw hour; his former figure was about 130 watt hours per cubic meter.—Lond. *Elec. Rev.*, June 9.

Ozone.—Various forms of ozonizers are discussed in an article by Otto in the *Ann. Chemiques et Physiques*, and a description is given of an apparatus for use with alternating currents by means of which 15 per cent. of the theoretical amount of ozone can be produced; the yield from Siemens' and from Andreoli's ozonizers, he claims, is less than 2 per cent. The abstract from which this is taken enumerates the chemical uses of ozone but gives no further information about the apparatus.—OTTO. *Jour. of Chem. Soc.*, May; abstracted in Lond. *Elec. Eng.*, May 26.

Solvay Process for Producing Bleach and Soda.—ROBERTSON.—A brief description of this process which has just been introduced. Mercury is used as the cathode and the electrolyte forms layers, thus dispensing with a diaphragm. The alkaline amalgam formed lies on the surface of the mercury and passes off over a weir which retains the bulk of the mercury, and there is thus offered continually a fresh surface of the mercury; in an adjoining vessel the mercury is freed from its sodium and then passes back into the original tank. The electrolyte consists of two distinct layers; the lower one resting on the mercury is saturated with salt, while the upper layer is lighter; as no gas is evolved the two layers do not mix; the lighter solution which is saturated with chlorine is thereby prevented from coming in contact with the mercury.—ROBERTSON. Lond. *Elec.*, June 9.

REFERENCES.

Theory of the Lead Accumulator.—DOLEZALEK.—A long theoretical article on the calculation of the dependence of the e. m. f. on the concentration of the acid, both for the accumulator as a whole and for each of the electrodes separately. The calculated results seem to agree quite well with those obtained by measurement. The e. m. fs. diminish rapidly with the dilution of the acid. The self-discharge of both plates increases rapidly with the concentration of the acid.—*Zeit. fuer Elektrochemie*, May 25.

Calcium Carbide Works at Meran.—An illustrated description of this plant referred to in the Digest, May 27.—*L'Ind Elec.*, May 25; a translation in abstract appears in the Lond. *Elec.*, June 9.

Theory of Dissociation.—VON OETIINGEN.—The beginning of a reprint of a paper read before the Chemical and Metallurgical Society of South Africa on this theory as applied to galvanic currents. The theory is concerned generally with the electrical pressure caused by contact of solid bodies with solutions and of solutions with one another.—Lond. *Elec. Eng.*, June 9.

Osmotic Theory of the Galvanic Cell.—NERNST and BOSE.—A brief abstract of the short article noticed in the Digest, Dec. 10.—Lond. *Elec. Eng.*, June 9.

Electrolysis of Sugar Solutions.—ULSCH.—A brief description of experiments with the electrolysis of solutions of raw sugar.—*Zeit. fuer Elektrochemie*, May 28.

Electrodeposition of Vanadium.—COWPER-COWLES.—A reprint of the article similar to those noticed in the Digest March 11 and May 13.—*Eng. and Min. Jour.*, June 24.

Sterilization of Water by Ozone.—ANDREOLI.—A long abstract of the article noticed in the Digest May 25.—*Eng. and Min. Jour.*, June 17.

Calcium Carbide Factories in France.—GUILBERT.—The beginning of a long abstract of a paper read before the International Acetylene Congress in Budapest giving brief descriptions of the various factories in France.—*Zeit. f. Elektrochemie*, June 15.

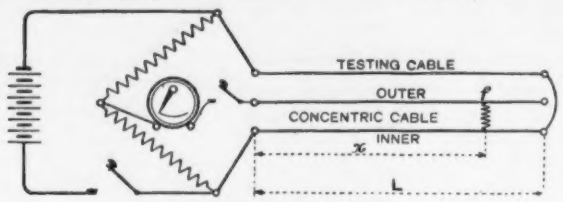
Power of Dissociation of Solvents.—KAHLENBURG and LINCOLN.—An abstract with numerous tables of figures from an article in the *Journ. of Phys. Chem.*, 3, p. 12.—*Zeit. f. Elektrochemie*, May 25.

Electrolytic Conduction Without Electrolysis.—A translation of the article noticed in the Digest April 8.—BEHN-ESCHENBERG. Lond. *Elec.*, June 2.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Testing for Faults in Concentric Cables.—In a recent paper by Mr. Kilgour on the Cheltenham mains, he describes a modified Murray loop test which he uses almost invariably, and with which he found it possible to localize faults with great accuracy. An abstract of the whole paper, which has already been noticed in the Digest, is reprinted in the Lond. *Elec.*, June 2. This method of testing has the advantage that a resistance of a few thousand ohms at the fault does not matter, and no attempt to reduce this is therefore necessary, thus enabling the cause of the fault to be found with a fair degree of certainty, which is not the cause when the fault is first broken down, in order to locate it. The arrangement is shown in the adjoining cut.

The inner or outer wire of the cable, preferably the former, as it is more likely to be intact, is made one arm of the bridge up to the fault; the remaining part of the same conductor and the return lead form the second arm; this return lead may be part of another cable



MODIFIED MURRAY LOOP.

or a special cable laid along the street for the purpose of the test, being joined to the far end of the faulty cable; one set of the proportional coils and the variable bridge resistances form the other two arms of the bridge; that one of the two conductors of the faulty cables which is not used as above described, is employed as a galvanometer lead to the junction of the two arms of the bridge at the fault, all of which is clearly shown in the illustration. Then if A is the ratio of the resistance of the faulty cable conductor (which is used as one bridge arm, up to the fault), to the resistance of the remainder of this conductor and the return lead in series; if B is the ratio of the resistance of the return lead to the resistance of the whole length of the conductor used as part of the bridge; if L is the length of the cable in yards and X the distance in yards to the fault, then

$$X = \frac{A\ (1 + B)}{1 + A}\ L,$$

or if b is the reciprocal of B then

$$X = \frac{A\ (1 + b)}{b\ (1 + A)}\ L,$$

—KILGOUR. Lond. *Elec.*, June 2.

Meter for Varying Rates.—HOSPITALIER.—After a brief discussion of each of the various systems that have been proposed, he describes with the aid of some illustrations the variable rate meter of Brown and Routin which registers at different rates for different times of the day. Only one meter and no separate wires are required; there is only one dial on which the varying rates are recorded. The meter itself, which is not shown, is a wattmeter and it registers and integrates the readings intermittently, the intermittent action being regulated by a clock at the central station; in this way the rate at which the meter registers is under complete control of the central station. A lever, which turns the ratchet wheel of the registering counter, is periodically raised against the action of a spring by an electromagnet controlled by the central station; the free end of the lever moves against a cam, the position of which is determined by the deflection of the wattmeter, as in many other meters of that type; at each impulse, the lever moves through the angle limited by this cam and registers a corresponding amount of energy. An ingenious method is used for operating this electromagnet without a separate wire. For a continuous current installation the station clock closes the circuit of a small alternator which is connected between the earth and one of the feeders; at the meter the electromagnet which operates the lever intermittently, is connected between the lead corresponding to that feeder, and the earth, a condenser being interposed; the electromagnet is therefore operated by means of an alternating current through a condenser. For an alternating current installation, the clock closes the circuit of a small continuous current dynamo of battery of accumulators, between the earth and one of the feeders; at the meter the electromagnet is connected between the lead and the earth; it is made to have such a high self-induction that a suitable impedance is offered to alternating currents, but a continuous current passes without difficulty. With high tension circuits the clock and magnet should be connected to the secondary circuit; this requires an extra wire from the station to the transformer.—*L'Ind. Elec.*, June 10.

Wehnelt Interrupter.—COX.—A brief abstract of a Röntgen society paper, the author being a well known maker of induction coils. He described some important discoveries in the working of the Wehnelt interrupter. The objection that X-ray tubes will not stand for any length of time when used with this interrupter, is overcome by using tubes of moderately low vacuum; they do not give quite as brilliant a production of X-rays, but the results are excellent and the tubes last longer; they can be worked from 10 to 20 minutes continuously; tubes with large bulbs run longer than those with small ones. With a 50-volt accumulator little or no resistance need be inserted, but with 100 volts an adjustable resistance is necessary. With two interrupters in series on a 100-volt circuit, the tubes run more evenly than when working with one. An especially valuable property is that there is no risk of burning up the coil, as the current is less when the interrupter stops than when it is working, in the proportion of about 7 or 8 to 1. The liability of the interrupter to stop is reduced by putting an inductance in circuit. When the active electrode is some distance from the cathode it works better than when quite close. A circulation of the liquid does not improve the working. The danger of an explosion arises from closing the interrupter with a lid. The times of exposure average from one-third to one-fifth as compared with the use of a mechanical break.—Cox. Lond. *Elec. Rev.*, June 9.

REFERENCES.

Methods of Determining the Frequency of Alternating Currents.—KINSLEY.—A brief illustrated review and discussion of five different methods that have been proposed and used, after which he describes his own, which he claims is free from most of the difficulties and errors in the others, and may be used with an accuracy of less than a quarter of a per cent. This latter method has already been referred to in these columns; it is based on the action of a flat iron bar which is made to vibrate in unison with the field by means of a non-magnetic rider.—Lond. *Elec.*, June 16.

Caldwell Interrupter.—COOKE.—A reprint of the article noticed in the Digest June 24.—*Elec. Rev.*, June 21.

Self-Winding Aron Meter.—GASNIER.—A long, well illustrated description.—*L'Ind. Elec.*, June 10.

Oscillographs.—BLONDEL.—A long illustrated abstract of his paper which was noticed in the Digest last year, describing his instrument. —Lond. *Elec. Rev.*, June 16.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Measurements of the Microphone.—The beginning of an article describing what appears to have been a long series of measurements of the microphone, telephone and coil. In the primary circuit he measured the alternating variation and the mean variation of the current; he endeavored to find whether the variation is due to a simple change in the resistance of the microphone or to an e. m. f. independent of the principal current such as a thermo electric or polarization effect; in the secondary he measured the e. m. f. induced in the coil, the currents generated, the difference of potential at the terminals of the telephone and the energy consumed in the telephone. He also determined how these quantities vary with the amplitude of the sound waves and with the period; also the amount of the movement of the membrane of the telephone and the plate of the microphone. In the present portion, after some historical notes, he describes the apparatus used.—CAURO. *L'Eclairage Elec.*, May 27.

REFERENCES.

Pacific Cable.—An analysis of the recent report of the committee appointed by the British Government.—Lond. *Elec. Rev.*, June 9.

Absorption and Cable Speeds.—A reply to the criticism of Shuter, noticed in the Digest, June 10.—SIEMENS. Lond. *Elec.*, June 2.

An analysis of the recent discussion with special reference to the recent table of Siemens, the correctness of which had been questioned.—Lond. *Elec. Rev.*, June 9.

Telephony.—A large number of short notes and a few articles on telephony, with special reference to the independent telephone movement. Among the articles is one by Clausen on minor telephone troubles and how to correct them, and another by Winfield on some of the difficulties encountered in the design, construction and operation of long distance telephone lines.—*West. Elec.*, June 24.

MISCELLANEOUS.

REFERENCES.

Engineering Conference.—Abstracts of the papers read at the meeting of the Institution of Civil Engineers, noticed in the Digest this week and last, are given in the Lond. *Elec. Rev.*, June 16. Some of the papers are also reprinted in the Lond. *Elec.* and *Elec. Rev.*, June 16.

Ferranti Works.—A brief description of these works in Hollinwood. One of the chief features of interest is the system of standardization of machinery fittings, which that company has always made a specialty of.—Lond. *Lightning*, May 25.

Removing a Hammer from an Artesian Well.—A note stating that a one-pound head of a hammer was successfully removed from an artesian well 260 feet deep, in Belmar, N. J., by means of an electro-

magnet which was lowered down in the well.—*Eng. News,* June 15.

Biographical.—A short biography with portrait of Gustav Wiedemann.—*Zeit. f. Elektrochemie,* June 1.

A short biography with a good portrait is also published in the *Phys. Rev.,* July.

New Books.

AMERICAN STREET RAILWAY INVESTMENTS. A supplement to the *Street Railway Journal.* Published annually, for the use of bankers, brokers, capitalists, investors, and street railway companies. 1899. New York: The Street Railway Publishing Company. 294 pages, 34 maps. Price, $5.

This publication, commonly called "The Street Railway Red Book," contains an account of each street railway in the United States, giving the populations of the city at a given date, the financial condition of the company, statistics of traffic, operating expenses, etc., together with the date of information. 34 large maps are bound in the volume, illustrating a corresponding number of street railway systems in large cities. The book will be very useful to those who are interested in the finance of street railway management.

BOOKS RECEIVED.

CHIMNEY DESIGN AND THEORY. By William Wallace Christie. New York: D. Van Nostrand Company. 164 pages, 41 illustrations. Price, $3.00.

TELEPHONES, THEIR CONSTRUCTION AND FITTING. A practical treatise on the fitting-up and maintenance of telephones and the auxiliary apparatus. Fifth edition. By F. C. Allsop. London: E. & F. N. Spon, Limited. New York: Spon & Chamberlain. 184 pages, 150 illustrations. Price, $1.25.

The Independent Telephone Convention.

LIST OF ATTENDANTS.

Adler, Philip
Ahearn, T. F.
Albert, W. W.
Anton, F. G.
Antram, W. H.
Averill, A. T.
Armstrong, Frank
Baird, Milton J.
Bandy, George W.
Barber, E.
Beam, Frank L.
Bear, S. J.
Bennett, C. F.
Bent, George W.
Bicknell, G. G.
Bishop, Fred.
Blount, R. F.
Bohart, P. L.
Bollmeyer, Fred J.
Boutiott, C. C.
Bowman, L. G.
Briggs, C. F.
Briggs, G. A.
Brown, C. E.
Brown, E. F.
Burk, L. S.
Burlingham, C. L.
Burlingham, F. W.
Burns, P. C.
Burridge, Charles
Butler, A.
Butler, W. H.
Butler, W. H. E.
Cadwallader, Ira.
Carter, W. H.
Charlton, M. A.
Chinn, C. C.
Chinn, H. C.
Chorpening, G. B.
Church, J. V. S.
Churchill, F. A.
Churchill, F. A., Jr.
Cobb, C. W.
Cokrill, Charles G.
Colbert, Frank E.
Cole, H. K.
Cole, L. C.
Collins, W. F.
Connelly, R. E.
Cook, F. B.
Cortine, John M.
Cory, W. E.
Cowdery, G. H.
Critchfield, H. D.
Croll, E. A.
Cumming, J. S.
Curtis, Carl C.
Cushing, L. K.
Deering, Charles C.
De Land, Fred
Deprey, David
Dinsmore, S. A.
Dilley, J. B.
Dohnan, W. L.
Dole, G. A.
Doolittle, W. E.
Dougherty, Hugh
Downs, B. B.
Drew, Charles E.
Durin, W. H.
Eisenhart, C. A.
Emanuel, Albert
Everley, William
Ewing, T. H.
Fair, Charles E.
Fair, George W.
Farron, P. G.
Felton, Robert.
Finch, George W.
Finney, Frank B.
Fisher, E. B.
Fledderjohann, W. H.
Flower, Charles
Folckmer, William
Frazee, L. A.
Freeman, P. J.
Fricker, Thomas
Fuclin, M. V. W.
Gladden, M. P.
Goddard, Stephen H.
Graves, F. E.
Green, George H.
Grudolph, F. W.
Guest, A. W.
Guilford, C. E.
Hall, Edward J.
Hammond, E. H.
Harper, J. C.
Harvey, F. E.
Harwood, E. M.
Heinemann, N.
Hertz, P. H.
Hertz, P. J.
Hill, A. D.
Hoge, J. B.
Holland, N. H.
Hopkins, W. A.
Horletter, C. A. J.
Hosen, M. F.
Hoyle, William
Hubbell, Burt
Hughes, George W.
Humphrey, E.
Hyde, I. B.
Ihmsen, J. G.
Jeffrey, Charles L.
Jennings, L. M.
Jones, G. D.
Joslyn, J. C.
Juvinall, C. D.
Kammeyer, C. E.
Keelyn, J. E.
Kellogg, M. G.
Kendall, Wilder
Knapp, E. A.
Knott, Dr. D. C.
Koohler, H. W.
Koontz, C. E.
Kusel, H. J.
Kusel, I. J.
Laby, W. W.
Landis, J. C.
Lane, E. C.
Lodge, H. C.
Lott, M. T.
Lumpkin, I. A.
Lundquist, F. A.
McConnell, E. P.
McConnell, J. S.
McCray, W. K.
McGill, J. H.
McGreggor, John
McNeal, H. B.
McVichir, D.
Maisen, F. J.
Malone, B. A.
Manner, H. T.
Markle, A. R.
Martin, E. H.
Mathews, H. E.
Miley, L. E.
Millard, A. L.
Miller, Carlisle B.
Miller, J. A.
Millman, J. T.
Mitchell, D. D.
Moellering, W. L.
Money, C. W. N.
Morris, A. B.
Morse, S. F. B.
Moss, W. E.
Munger, E. T.
Munsell, A. L.
Murray, C. H.
Murray, K. V.
Mutreany, George H.
Newman, Dewey
Nicholson, William E.
Norstrom, J. K.
Odell, C. W.
O'Hara, J. B.
Onsott, Wiley H.
Orr, W. H.
Ortin, H. G.
Overshiner, E. B.
Overshiner, J. M.
Passano, L. D.
Patten, F. B.
Patterson, W. P.
Pickart, C. E.
Pietzcker, E. J.
Pierce, F. M.
Pierce, Roy S.
Pitcher, L. D.
Place, J. W.
Platt, C. P.
Pollock, F. H.
Post, C. R.
Presson, A. T.
Price, H. A.
Pruden, H. B.
Pugh, H. O.
Pugh, J. D.
Pyke, A. D.
Rall, S. A.
Ralston, H. E.
Ramsey, A. E.
Reedy, G. B.
Reeve, C. A.
Reutinger, A. H.
Rex, O.
Robinson, William
Rogers, E.
Ross, Robert
Russell, George W.
Russell, J. A.
Sale, James W.
Sale, John W.
Salmon, C. B.
Sampson, Edward
Sands, L.
Sapp, D. E.
Sapt, F. F.
Schance, J. G.
Schirmer, F. M.
Schumacher, F. C. H.
Schweizer, Charles H.
Seaton, W. B.
Sennott, Thomas W.
Serviss, W. B.
Seylar, Carl
Shafer, Henry
Sheerin, S. V.
Shelby, Evan
Shewman, Allen
Shimel, C. W.
Shove, Henry
Silberberg, Max
Singleton, Don
Smart, R. M.
Sohmiller, William
Speed, J. J.
Spicer, W. H.
Springer, F. L.
Stauffer, M. T.
Stein, A.
Stephens, John A.
Stevenson, G. M.
Stitch, George F.
Stoops, Claud R.
Strickler, F. R.
Stromberg, A.
Taylor, J. G.
Teale, Burt
Thomas, James M.
Thompson, J. M.
Tickinson, O. K.
Tompkins, J. F.
Towle, S. W.
Upham, W. P.
Van Deusen, G. S.
Van Middlesworth, W.
Vernier, A. J.
Vesey, W. J.
Ware, J. B.
Warner, Perry M.
Watson, W. W.
Wayland, S. E.
Weilman, H. F.
Wellman, S. A.
Weiant, W. S.
Wettstein, Otto, Jr.
White, F. R.
White, George S.
Wilcox, A. M.
Wiley, J. R.
Williams, J. A.
Withoft, F. G.
Wolff, James
Wright, William A.
Young, H. C.
Young, L. C.

Convention Notes and Exhibits.

KEYSTONE ELECTRIC TELEPHONE CO. was represented by Mr. J. G. Ihmsen.

H. A. PECUNIER was in charge of the exhibit of the Moon Manufacturing Company, of Chicago, which showed a full line of its well known goods.

THE EUREKA TELEPHONE CO., of Chicago, had a large exhibit, with four or five representatives looking after its interests. A complete line of telephone goods was shown.

THE VICTOR TELEPHONE MANUFACTURING CO. showed the "Victor" express switchboard, the "Victor telephone" and a number of the specialties made by the company.

THE ERICSSON TELEPHONE CO., a new company, was represented by L. P. Smith. Coal grain microphones, new styles of pliers and a new telephone were shown in the exhibit.

THE CHICAGO TELEPHONE SUPPLY CO. exhibited a full line of its standard goods, well known to the telephone world. G. A. Briggs was in charge of the company's interests at the convention.

MR. MILO G. KELLOGG represented the interests of the Kellogg Telephone & Switchboard Company, which has lately been busy enlarging the Kinloch exchange, using its apparatus for several thousand subscribers in St. Louis.

FRED GREER, manager of the Harvard Electrical Company, of Chicago, assisted by A. J. Kusel, exhibited the full line of fuses, fuse blocks and lightning arresters which the company makes. The "Harvard" fusible cut-out and a lot of one-eighth ampere fuse wire were especially noticeable.

THE WIRE COMPANIES were rather slimly represented at the convention. James Wolf, the Western manager of the New York Insulated Wire Co., and J. R. Wiley, the Western manager of the Standard Underground Cable Co., were on hand, but the members of other companies were extremely scarce.

ILLINOIS ELECTRIC CO.—In charge of the exhibit of the Illinois Electric Company were Dewey Newman and H. E. Adams. They had a display consisting of standard telephone supplies of a general nature. The exhibit was of interest to the financial men of the various telephone companies represented at the convention.

WESTERN TELEPHONE CONSTRUCTION CO.—Best modern practice in the equipment of toll lines was illustrated by the exhibit of the Western Telephone Construction Company. Exchange and toll line apparatus was shown in a variety of forms. New and valuable types of magneto bells formed a prominent part in the display. President James E. Keelyn and General Superintendent Harry Dodge attended the convention.

STROMBERG-CARLSON CO.—One of the handsomest instruments exhibited in connection with the convention was the product of the Stromberg-Carlson Telephone Manufacturing Co., of Chicago. This telephone attracted a great deal of attention. At the company's factory visitors were shown numerous improved telephones, switchboards and supply specialties. President A. Stromberg and Manager Henry Shafer attended the convention.

THE UNITED STATES TELEPHONE MANUFACTURING CO. was represented at the convention by its president, Frederick A. Churchill, Jr. As one of the two St. Louis companies which had an exhibit there, it gave a good idea of the progressive spirit of the telephone men in the Missouri metropolis. Though only a new company organized for the sale of supplies, it had a full line of improved goods on display, including many of the new makes. The exhibit was the headquarters of many of the delegates to the convention.

THE CENTRAL TELEPHONE & ELECTRIC CO. was one of the two St. Louis companies represented at the convention by exhibits. This company had a room full of interesting apparatus. Its new "Twentieth Century" telephone was shown in a number of styles. A feature of the exhibit was a full line of transmitters. Two complete switchboards were shown, one wired with metallic return circuits and the other with the older single return.

ADAMS-BAGNALL.—The interests of the Adams-Bagnall Electric Co., of Cleveland, were looked after at the convention by J. G. Pomeroy, the Western sales agent. E. R. Harding, the Western representative of the Holtzer-Cabot Electric Co., of Boston, and Newman H. Holland, of the same company, were both present in the interests of their company. C. W. Cobb represented the Central Electric Company, of Chicago. Beyond these three companies the general run of electrical supply houses took but little interest in the convention.

WILLIAMS ELECTRIC CO.—Looking after the interests of the Williams Electric Co., Cleveland, were President J. A. Williams and General Manager Bert Hubbell. They had a full exhibit of their special makes of receivers and magneto bells. This company prides itself on the fact that all its apparatus is new and different from other styles. A magneto bell in which the gear wheels were designed to stand wear for a great length of time attracted special attention. The new "No. 25" telephone was also the centre of considerable interest.

MR. SANDS, the inventor of the well known Sands bipolar receiver, took personal charge of the exhibit of the Williams-Abbott Electric Co., of Clevland. His display consisted of a power generator, a complete line of magneto bells, transmitters of several styles, a variety of receivers, and all the standard parts sold to assembling companies. The feature of the exhibit was naturally the Sands bipolar receiver. This was shown in both the "Standard" and "Pony" types. Its means of adjustment were frequently and favorably commented on by central exchange experts.

THE SMITH INTERCHANGEABLE TELEPHONE, made by a Chicago company of the same name, was one of the most interesting novelties of the various displays. This is a clever and curious development of the telephone, made so as to fold up into a small compass. It can be easily held in the hand, and for that and other reasons is especially valuable for use on shipboard. The Government is now testing the apparatus for introduction on board men-of-war, and the outlook for its adoption is represented to be most favorable. This telephone is also valuable in commercial work.

THE FARR TELEPHONE & CONSTRUCTION SUPPLY CO. was important in the makeup of the convention through the presence of President Charles Farr, who took a leading part in the arrangements. This company exhibited a full line of the goods which it sells, consisting of magneto bells, combined fuse blocks and lightning arresters, switchboards, interior exchange systems and telephone supplies in general. The company distributed an interesting catalogue and handbook of information, which is stated to contain enough valuable advice to enable a farmer to install and use a telephone. The company sells only for cash, and does not do any construction work. It has recently adopted a scheme of special trade discounts which is resulting in inducing many of the general electrical supply houses to deal in telephones—a thing they have not undertaken in the West to any great extent as yet.

A STRIKING EXAMPLE of Yankee progressiveness was shown by the American Electric Telephone Co., of Chicago. Instead of an elaborate exhibit displayed at the headquarters of the convention, the company decided to rely on the effect produced by a view of its works, located a few blocks away. To attract the delegates to the factory the clever scheme was adopted of giving them an automobile ride. An electric cab of improved make was kept standing at the Auditorium entrance, at the disposal of any members who wished to make a visit to the company's factory and incidentally to have a breezy run in the "twentieth century vehicle." Mr. P. C. Burns, the president of the company, was in attendance at the convention, and piloted many interested parties of members through the company's large new building at 38 to 50 Jackson boulevard. There the well known apparatus made by the company was shown and its merits fully explained.

NATIONAL AUTOMATIC TELEPHONE CO.—The exhibit of the National Automatic Telephone Co. was shown at the Great Northern Hotel, a few blocks away from the general headquarters of the convention. F. A. Lundquist, the president of the company, and the inventor of the apparatus which the company makes; J. K. Nordstrom and J. A. Russell were present in behalf of the company. Two exchanges, one for an office and one for general subscribers, were shown in operation. This system does away entirely with the "hello" girl, all connections being made automatically by the apparatus. Connection is effected by turning a small handle on a numbered dial on the face of the instrument. The apparatus at the switchboard does the rest. Mr. Lundquist says his system can be applied to exchanges having 9999 subscribers, but so far 200 is the highest number accommodated in practice. There are 60 or 70 exchanges now using this system. The company reports orders enough to keep its factory going till fall.

THE NATIONAL CARBON COMPANY, of Cleveland, which boasts of being the largest company in its line in the world, had one of the most complete of the exhibits at the convention. Seventy different styles of back plates used in making transmitters were shown, together with the forty kinds of globular and granular carbons put with them. Carbon diaphragms of astonishing thinness and toughness and of a great variety of sizes were also exhibited. Twenty-six different kinds of cells formed a part of the display, including a full line of Columbia dry batteries. Among the novelties were a renewable Le Clanché cell, in which the porous cup screwed off, and a duplex cell, consisting of two elements combined in a glass jar so as to give an unusual amount of electromotive force in a compact space. F. H. Murray was in charge of the exhibit.

THE STERLING ELECTRIC CO. was, as was to be expected, one of the most conspicuous manufacturing companies during the convention. From the small colored youth in livery who distributed the attractive circulars of the company, to the carriage which stood at the door ready to take all visitors to the company's factory, the Sterling Company was noticeable and noticed. Main reliance for producing an effect on the visiting members of the association was placed on the company's factory, which was visited before the end of the three days of the convention by nearly every out-of-town delegate. The non-interfering party-line apparatus shared popular attention with the Bell pattern goods. Other products of the factory that were closely examined were the company's makes of switchboards, distributing board cable terminals, poletop terminals, protectors, lightning arresters, tubular line fuses and fuse blocks. W. H. Doolittle was in charge of the reception and entertainment of visitors, and spent a great deal of time at the convention.

A New Factory for the American Electric Telephone Company.

A very fine addition to the telephonic manufacturing facilities of this country has just been made in the new building of the American Electric Telephone Co., 38 to 50 Jackson Boulevard, Chicago. President P. C. Burns states that the rapid growth of the company's business was such as to compel this change and enlargement, and the great demand for their product all over the country is but a confirmation of all his statements. The development of the independent telephone exchanges was never more rapid than it is now, and great as is the increase in the company's plant, it is doubtful whether even at present they can do more than keep pace with their influx of orders for new exchanges and enlargements of old ones.

The factory thus acquired, and equipped with the latest and best machinery for turning out telephone apparatus, is an eight-story building which covers full half a block. The whole of the ground floor is given up to the company's general offices, and it is said that the factory will actually be the largest in the world wholly and solely devoted to the production of telephonic apparatus and appliances.

The Willyoung Apparatus.

Mr. Elmer G. Willyoung, the well known instrument expert and manufacturer, trading in Philadelphia during the past few years under the style of Elmer G. Willyoung & Co., announces that he has sold his plant in lump in that city and has removed his headquarters to New York City, where he will continue his business on a greatly enlarged scale. Mr. Willyoung has made a close alliance with Messrs. Foote, Pierson & Co. for a term of years. They are the successors of the manufacturing department of E. S. Greeley & Co., and are most favorably known to the electrical fraternity as manufacturers of high class telegraph appliances and experimental apparatus. Their shop capacity and equipment is now being doubled to make room for Mr. Willyoung's work, and when improvements

now under way are completed they will give employment to over 100 men and have a floor space of over 10,000 square feet. By the terms of their agreement. Messrs. Foote, Pierson & Co. will manufacture at Mr. Willyoung's direction and under his personal supervision the complete line of Willyoung apparatus, X-ray machines, etc. All of the instruments have been lately gone over and many improvements effected, and it is believed that the line is now thoroughly up to date in every way.

All exclusive sales agency contracts have been annulled, and Mr. Willyoung will henceforth sell his own apparatus direct and through the trade generally. The designing and calibration will be under his personal supervision. A number of Mr. Willyoung's best men have been brought over from Philadelphia, including his old foreman and chief adjuster, so that the highest quality of work is assured.

Pending the issuance of a new catalogue, now in preparation, Mr. Willyoung invites inquiries of intending purchasers, whom he will be glad to correspond with. Mr. Willyoung's address is 82 and 84 Fulton Street, New York City, and the style is now Elmer G. Willyoung.

A Shadowless Poletop.

The effectiveness of any system of street lighting depends largely upon the uniformity of illumination and the avoidance of shadows. In the case of the common type of poletops (fixtures for the support of arc lamps over the tops of poles) the projecting arms which hold

CUTTER'S SHADOWLESS POLETOP.

the uprights and which also carry the insulators, often cast a large and deep shadow near the foot of the pole. Realizing this, the George Cutter Company, of Chicago, besides making the "Standard Poletop," has also designed a new form of poletop which marks a radical departure from the older type. The new form has the supporting pipes drawn in close to the side of the pole and fastened to it by means of a plate bolted to the top. This enables the fixture to be put up without trimming the pole to fit a cap, and also does away with the widespreading base used on the older type. The hanger-board in the hood is planned to bring the side rods of the lamp in line with the uprights, so that the latter will cast no additional shadow, and the absence of the broad base makes the device practically shadowless.

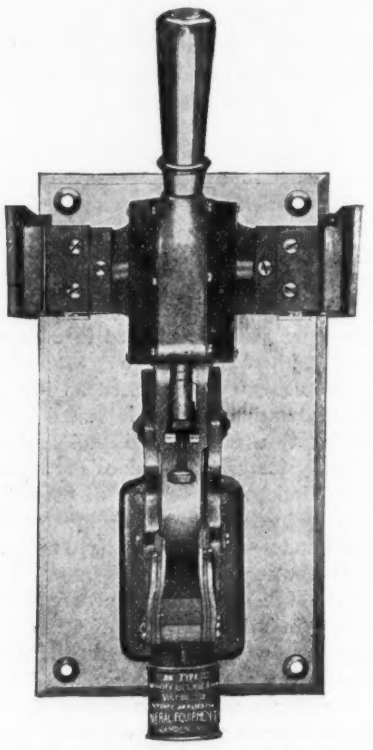
General Equipment Circuit Breakers.

A late device in the line of protective apparatus is the type of circuit breaker shown in the accompanying illustration. This machine is manufactured by the General Equipment Company, of Camden, N. J., and has been designed to meet the requirements of high and low voltage direct and alternating current work.

This circuit breaker is different in its general design from anything now on the market. The coil and tripping mechanism are mounted on the arm. When the machine opens, from an overload, all the working parts are removed absolutely from the terminals, leaving a clear space of over five inches between them. The spring actuating the lever arm is at the base of the breaker and is adjustable to any required tension.

The latest improvements in machine design are used on this device. It has roller bearings throughout, and the trigger spring is of the enclosed barrel type. All parts are of the highest grade material and current carrying parts are pure copper. The finish and general workmanship are of the best class, and each detail is thoroughly worked out, the whole combining to make one of the most efficient and serviceable machines now manufactured. In case the circuit breaker is mounted directly on the switchboard it is necessary to drill but six holes, four for the base and two for the terminals.

The General Equipment Company is also manufacturing a special form of circuit breaker for street railway cars and automobiles. The instrument is mounted on a slate base contained within a small substantial oak box. The arm of the machine forms the lid of the box, which on opening carries with it the coil, tripping mechanism, etc., and allows the arcing vapor and gases to readily escape. The terminals are protected by ample carbon contacts. The distance be-



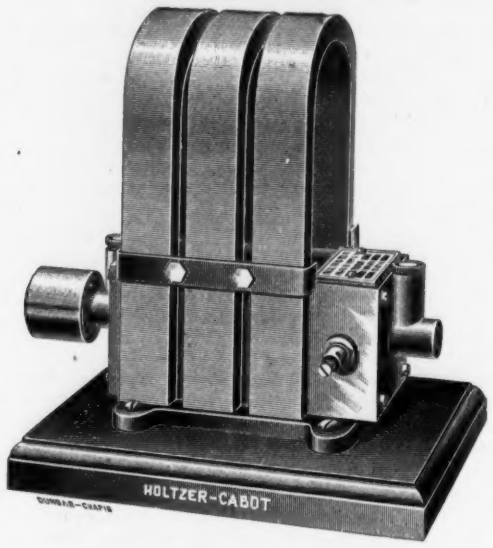
NEW TYPE CIRCUIT BREAKER.

tween them is over five inches and when the circuit breaker opens the mechanism is removed from the live parts. No fuses are required to protect the terminals. This type of machine has the same general design as the switchboard type. An accurate account of the number of times the circuit breaker opens is registered by a small recording device.

The over-all dimensions are 8"x8"x4" and it can readily replace the fuse box ordinarily used on cars. By the use of this car type of circuit breaker an accurate check is kept on the motorman who overloads and abuses the apparatus. It is stated that in all cases where these breakers have been adopted the current consumption per car is materially decreased.

Holtzer-Cabot Gas Engine Igniter.

The ignition of the charges in gas and gasoline engines is a problem that has received much attention, the essential objects sought being reliability and regularity of the igniting spark. Batteries, both wet and dry, are used for this work, but a machine-



MAGNETO GAS IGNITER.

generating spark is regarded by many as being more reliable and satisfactory.

The apparatus illustrated herewith is a magneto gas igniter made by the Holtzer-Cabot Company, Brookline, Mass. The field magnets are of the permanent type, and the armature is of the drum type. The armature is enclosed in such a manner as to be oil, moisture and dirt proof, which feature renders the machine especially adapted for marine work. It can be run in either direction, and may be driven by a friction pulley or by belt connection with the flywheel or any convenient shafting. In connection with this igniter the Holtzer-Cabot Company recommends the use of its automatic switch which cuts the generator into circuit when the voltage is sufficient to produce the proper spark. These igniters are said to be giving satisfaction in actual use.

Leffel Automatic Cut-Off Engine.

The accompanying illustrations represent a centre crank automatic cut-off engine, being put on the market by James Leffel & Co., Springfield, Ohio, which type is intended to meet the demand for a thoroughly good, simple and easily cared for line of automatic engines in the smaller sizes up to 50-hp, and which will prove durable and economical in operation. Fig. 1 is a view showing the steam chest side, and Fig. 2 illustrates the governor in the band fly-wheel.

The main frame or bed is of substantial proportions, and of a design affording extra strength and stiffness. The cylinder and steam chest are of the overhanging type, cast together, and firmly bolted to bed. The cross head guides are a part of the bed, bored out, and have generous surface. The cross head is of an improved mechanical design, having the pin about mid-centre, and is provided with gun metal wedge-shaped shoes above and below, arranged for convenient adjustment. The manner of fitting the cross head pin enables it to be easily kept absolutely tight at all times. The piston rod is of steel, and is turned to a tight force fit in the piston, with suitable shoulder, against which the piston is forced on the rod, the end of the latter being then securely riveted over, thus tightly and firmly holding the piston in place.

The connecting rod is provided with extra heavy brass boxes at each end, easily adjustable for taking up wear and keeping the distance between centres the same at all times. The main shaft is extra large and strong, forged in one solid piece from the best quality of hammered iron or steel, and is provided with suitable counter-balance discs, securely attached. The rectangular form of skeleton slide valve is used, and is balanced by being fitted with a pressure-relieving plate on the back between the valve and steam chest lid, and is arranged so as to afford necessary relief in case of water in the cylinder, and also made adjustable for wear. This gives a simple, efficient and well balanced valve, which is easily understood, and requiring no more trouble to care for than the ordinary type of plain slide valve. A simple and convenient device (not shown in the cuts) is provided for draining the cylinder, being operated by one lever and having an outlet from each cylinder cock suitably connected to exhaust pipe.

These engines are equipped with the Rite's governing system, which is the acme of simplicity, as shown in Fig. 2. The governor consists of one piece, comprising the arms and weights, with one spring connection, and is pivoted on one hardened steel pin, there being no links, numerous joints or complicated parts. This governor, with the balanced valve used, affords a regulation that is claimed to be practically perfect, the speed being constant with the engine loaded or running empty.

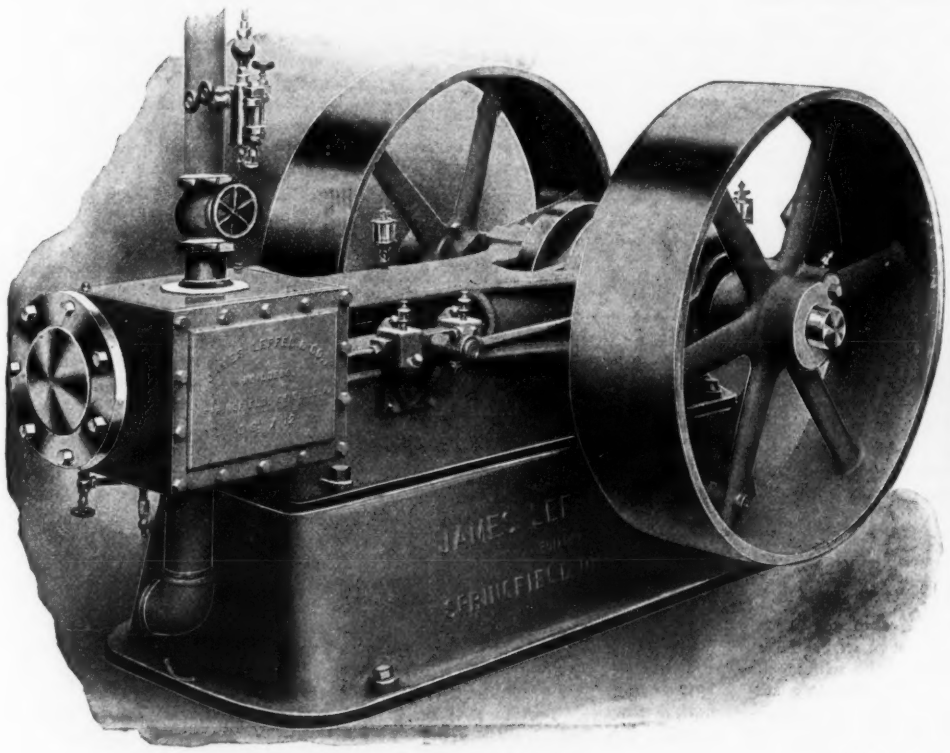


FIG. 1.—LEFFEL AUTOMATIC CUT-OFF ENGINE.

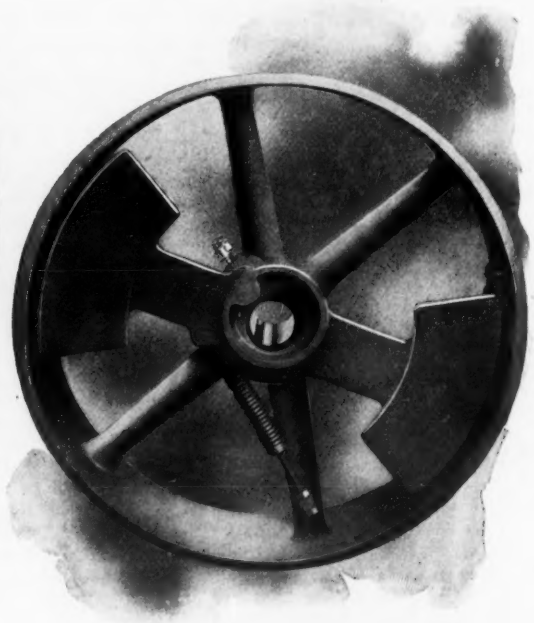


FIG. 2.—FLY-WHEEL GOVERNOR OF LEFFEL ENGINE.

NEWS OF THE WEEK.

Financial Intelligence.

BOSTON ELEVATED RAILWAY COMPANY has declared a dividend of 3 per cent., payable Aug. 15.

NEW ORLEANS CITY RAILROAD COMPANY has declared a dividend of 2½ per cent. on its preferred stock.

ILLINOIS DISTRICT TELEGRAPH COMPANY, of Chicago, is increasing its capital from $100,000 to $200,000.

PHILADELPHIA UNION TRACTION.—The increase in Union Traction gross earnings for June to date, over last year, averages between $3000 and $4000 per day.

STANDARD OIL CAPITAL is reported to be investigating street railways in Sioux City, Omaha, St. Paul, St. Joseph and other western cities, with the object of acquiring the properties.

NEW YORK & QUEENS.—First mortgage 5 per cent. gold bonds to the amount of $900,000 on the property of the New York & Queens Gas & Electric Company are being offered for public subscription by Wilson & Stephens at 105 and interest.

METROPOLITAN STOCK.—It is reported that Metropolitan directors are preparing to issue a call to stockholders for a special meeting to authorize an issue of $5,000,000 new stock to be given to stockholders on a basis which will be equivalent to a cash dividend of about 15 per cent.

ELECTRO-PNEUMATIC.—Mr. Leopold Wallach, counsel to the Reorganization Committee of the Electro-Pneumatic Transit Company, states that the company is in a position to obtain some business, and that an assessment is proposed to furnish working capital. The amount of the assessment will be decided upon this week.

STATEN ISLAND, N. Y.—Haligarten & Co. have informed holders of certificates of deposit for Staten Island Rapid Transit Railroad Company second mortgage 5 per cent. gold bonds, issued under bondholders' agreement of July 5, 1898, that they will pay to holders thereof $76.87 for each bond represented by said certificates, being the equivalent of the interest due July 1, 1898; Jan. 1, 1899, and July, 1899, on each bond, together with interest thereon at 5 per cent.

STREET RAILWAY MERGER IN NEW YORK.—Last week closed with reports and denials of a pending ratification of a plan of merger of Metropolitan Street Railway, Manhattan Railway, Third Avenue Railway and Brooklyn Rapid Transit, with a total capitalization of $147,000,000. Even those who did not regard the step as immediately probable, spoke of it as inevitable in the long run, and as likely to benefit the public enormously by the extension of the free transfer system.

METAL MARKET.—As a general thing, there is a scarcity of materials in all parts of the metal market, and the second half of the year starts with a range of higher prices on such staples as iron and steel. Conditions all favor producers. Copper is a bit duller and steadier at 18 cents, but it is alleged brisker buying has begun, which may force it up somewhat. The present price is high enough for comfort. Lead is a trifle higher at 4.35 cents. Heavy steel rail, Eastern mill, is quoted at $28.

NEW CHICAGO STOCK ISSUES.—Two important Chicago institutions increase their capital stock $1,000,000 each July 1. They are the Chicago City Railway Company and the Illinois Trust and Savings Bank. Each of these will add $1,000,000 to its capital, the new shares going to present holders at par. City Railway is worth 284, and Illinois Trust 625, so the "rights" in both cases are valuable. The Chicago Telephone Company has just sold about $660,000 of its unissued stock, and the Chicago Edison directors have authorized the addition of another million to the capitalization of that company.

MASSACHUSETTS ELECTRIC COMPANIES.—It will probably be some time this week before definite figures can be given as to the subscription for stock of the Massachusetts Electric Companies. The managers say subscriptions were entirely satisfactory. At a meeting of the Massachusetts Electric Companies the following officers were chosen: President, Amos F. Breed; vice-president, Charles E. Cotting; secretary, Everett W. Burdett; treasurer, J. H. Goodspeed. The Executive Committee will consist of Messrs. Gordon Abbott, Charles Francis Adams 2d, E. N. Foss, Percy Parker and Philip L. Saltonstall. Mr. P. F. Sullivan will be general manager.

WESTERN UNION.—A financial writer in the New York *Press* says: "What about Western Union Telegraph? Well, the persistence of speculative holders will finally be rewarded. There are already on foot negotiations which will enable that company and the Postal Telegraph Company to be united to a sufficient extent to reduce the cost of operating enormously, by abolishing duplicate and superfluous offices and lines. Western Union has a splendid dividend-paying record, and it is absurd that it should sell at 90, paying 5 per cent. annual dividends. When the telegraph combination is capable of being proved to exist Western Union will be above par."

NEW YORK THIRD AVENUE.—Stockholders of Third Avenue will meet July 19 to consider an increase of capital stock from $12,000,000 to $40,000,000 and the stockholders of the Forty-second Stret and St. Nicholas Avenue meet the same day to vote on increase of capital stock from $2,500,000 to $7,500,000. "The new stock," Edward Lauterbach says, "will be issued as required to pay for improvements and for the extinguishment of the floating debt, which amounts to about $10,000,000, and was created by the purchase of the stocks and securities of other companies." This will leave no debt excepting the company's bonded debt of $5,000,000, and the bonded debts of the constituent companies. The improvements will take in the Third Avenue, the Forty-second Street and the Dry Dock, East Broadway and Battery roads and the various lines of the Union Railway. The new stock will probably be issued at par.

NEW HAVEN, CONN.—The prospectus of the Connecticut Lighting & Power Company shows plans of considerable amplitude. The sum of $6,000,000 is to be issued as a blanket mortgage, in 4½ per cent. long-time bonds, of which about three and a quarter millions are to be used to pay for the Waterbury Traction, the New Britain Central & Electric, the Norwalk Street, the Naugatuck Electric Light, and Housatonic power properties. The sum of $600,000 is to be used to retire, if possible, bonds of the Greenwich, Stamford and Norwalk lighting properties, and $1,000,000 is to be used for building the projected great Housatonic dam, near Zoar Bridge, to supply electric power. After other expenditures about $750,000 is to be left in the treasury for future needs. The amount to be used of the large blanket-mortgage bonds to pay for the stock of the acquired companies is not stated. The first mortgage bonds of the New Britain and Waterbury properties, stated in the last Railroad Commission report as $1,164,000, will be retired at 104 and interest, as an option in the bonds allows.

STANDARD UNDERGROUND.—The stockholders of the Standard Underground Cable Company have voted an increase of $500,000 in the capital stock of the company. This increases the capital stock of the company from $1,000,000 to $1,500,000. Of the increase $400,000 is to be issued to the present stockholders out of the undivided earnings of the company. The remaining $100,000 is to be offered to the stockholders for subscription at par. The increase in the capital stock is for the purpose of providing means for extending the works of the company and to add to the working capital. It is said that it is the intention of the company to add to its plant improved apparatus so that it may engage extensively in the manufacture of deep water cable. The company, it is stated, will then be in a position to bid for the contract for furnishing the cable for the proposed line between San Francisco and the Philippine Islands by way of the Hawaiian Islands. At the meeting of the directors, a regular quarterly dividend of 2 per cent. was declared. The par value of the stock of the cable company is $100 per share. On the market, however, the stock was quoted last week at $208 per share. The officers of the company are Mark W. Watson, president; Joseph M. Marsh, vice-president and general manager, and F. A. Rinehart, secretary and treasurer. The other directors are James H. Willock, George B. Hill, John Moorhead, Jr., Robert Pitcairn, B. F. Jones and J. N. Davidson.

THE WEEK IN WALL STREET.—The present holiday season is necessarily dull, but there has been a continuous manifestation of strength and activity which bodes well for the general conditions of trade and finance in the fall. While money is dearer than at this time last year, it appears to be so because this country is a creditor in Europe, and has gold to sell. If we have good crops this year, nothing can stand in the way of an increase of our creditor balance, as manufacturing exports increase all the time. During the past week, 2089 shares of Western Union were sold, up to 90¼, with a slight gain for the week. Only 900 shares of General Electric were dealt in, being steady around 117. On sales of 266,177 shares, Brooklyn Rapid Transit declined 1⅛ to 115⅛. Manhattan Elevated, on consolidation rumors and reports of the early adoption of electricity, rose 5 points to 118¾, while Metropolitan Street Railway gained 1⅝ on sales of 35,480 shares. In Boston, American Bell Telephone was quoted firm at 355, Erie Telephone at 98, Mexican Telephone at 4, Boston Elevated at 108½. In Philadelphia, Electric Storage Battery, preferred, was quoted at 135 bid, 140 asked. Pennsylvania Manufacturing Company 323¼ asked, Philadelphia Traction 100 asked, Union Traction 43¼, Electric Company of America, 19⅛. In New York, in "outside" securities, Electric Vehicle was quoted at 102 to 106 common, and 115 to 125 preferred. Electric Boat was quoted at 18 to 22 common, and 44 to 46 preferred.

THE STATE OF TRADE.—In its review of the week Bradstreet's says: "The closing week of the half year finds special strength and activity in iron, lumber and wool, and woolen goods, the latter industry having at last apparently begun to share in the prevailing prosperity. A feature of interest in this connection is the advancing prices of fine wools abroad, which seems to insure, temporarily at least, a foreign market for considerable high-grade domestic wool. Manufactured fabrics share in this strength, but manufacturers are not credited with having large stocks of raw material. Confidence in a good fall trade is evidenced by reports coming from many markets of good orders already booked, the volume of such business already done varying from 10 to 30 per cent. in excess of last year, which, it may be recalled, was quite a satisfactory one in this respect. A low ebb may be said to have been reached in failures, current embarrassments being the smallest and least important noted for many years. For the first six months the total number reported has been 5049, with liabilities of $50,304,253. This is a decrease as regards number of 21 per cent. from last year, of 28 per cent. from 1897, and of 34 per cent. from 1896, while the liabilities are 30 per cent. smaller than they were a year ago, 46 per cent. less than in 1897, 52 per cent. less than in 1896, and 10 per cent. less than in 1892. In number, in fact, failures are fewer this year than they have been for seventeen years past, and the liabilities are smaller than in any year since 1881. That current embarrassments are well down to the normal is proved by the fact that assets this year constitute only 45.5 per cent. of the liabilities, against 50 per cent. last year, 57 per cent. in 1897, and 61 per cent. in 1893. Large failures were specially scarce during the second quarter of the year. Bank clearings for the week reflect increased speculative interest in New York

in a slight gain over those of last week, the total aggregating $1,636,324,137, an increase of 1 per cent. over the preceding week, of 41 per cent. over the corresponding week a year ago, of 85 per cent. over 1897, of 92 per cent. over 1894, and of 59 per cent. over 1892.

Special Correspondence.

NEW YORK NOTES.

TELEPHONE MANUFACTURING.—It was reported around New York last week that the consolidation of independent telephone manufacturers, of which many details have been given, is subject again to further postponement. It had been hoped to close it up by this time, but its consummation is now indefinite.

MR. HARRY PAYNE WHITNEY, who is now president of the New York Electrical Vehicle & Transportation Company, has been making rather a sensation at Newport with his beautiful automobile Victoria, of Columbia make, with seats behind for two footmen. It travels very smoothly, responds admirably to his control, and is one of the prettiest electric vehicles in the country.

INSULATED WIRE DEAL.—Rumor has been freely in circulation the last few days to the effect that the consolidation of insulated rubber wire manufacturers is not likely to come off just at present. The exact reason for the failure to accomplish it at the present moment is said to be the difficulty of getting five of the larger concerns into line on a reasonable basis.

MR. ISAAC L. RICE, the president of the Electric Vehicle Company, has purchased from Gen. Egbert L. Viele the well-known Viele residence at the southeast corner of Riverside Drive and West Eighty-eighth Street. The transaction is a large one, and a notable feature of it is that the property is paid for entirely in cash. The house is a large three-story brick structure with stone facings. The high stoop facing on the drive is bounded on either side by two white marble sphinxes which draw the attention of the passerby at once. Mr. Rice will improve the dwelling at considerable cost, and make it his residence. The interesting feature is that rumor attributes to Mr. Rice the intention to have the first private automobile stables there to be equipped in this city, just as he was the first man in this city to own and operate an automobile for himself.

PITTSBURG NOTE.

PROFESSORS R. H. RICHARDS and H. O. Hofman, of the Massachusetts Institute of Technology, have been in this city for the last few days, studying the practical workings of the local electrical and other industrial establishments. They were accompanied by ten pupils from the institute.

OHIO NOTES.

THE SHELBY ELECTRIC COMPANY, Shelby, Ohio, a few days ago received an order for 3000 lamps from Adelaide, South Australia.

ELECTRIC STAGE COACHES.—A company is being formed at Canton to operate an electric stage coach line from Canton to Congress Lake, a distance of 13 miles.

THE HERBERT ELECTRIC COMPANY, of Dayton, was the lowest bidder and has been awarded the contract for the electric lighting plant and fixtures for the new post office building at Boston. The bid was $16,000.

THE CLEVELAND ELECTRIC COMPANY is negotiating with the city authorities of Chattanooga, Tenn., for a franchise for a new telephone system. Thus far the proposition has been favorably received. The Cleveland Company guarantees an independent telephone exchange with cheaper rates than are charged by the local company.

THE COLUMBUS, WINCHESTER & LANCASTER TRACTION COMPANY, with a capital stock of $1,000,000, has applied for incorporation papers to operate an electric railway from Columbus, through Groveport, Canal Winchester, Carroll and Lancaster camp ground, to Lancaster. The incorporators are Thomas A. Simons, Richard E. Jones, David C. Beggs, Howard C. Parks, Franklin D. Simons and F. N. Banderli, of Columbus, and Franklin Post and Theodore B. Beatty, of New York. It is the intention of the promoters to ultimately extend the line to Logan and Athens.

AN EXTENSIVE ELECTRIC RAILWAY SYSTEM.—Messrs. W. W. Hazzard, of Cleveland, president of the Alliance Street Railway Company; C. L. Davis, president of the Salem Street Railway Company, and John C. Whitla, president of the recently incorporated Alliance, Sebring & Salem Electric Railway Company, are figuring on an extensive electric railway system to connect Canton, Louisville, Mt. Union, Alliance, Johnsons Crossing, Sebring, Beliot, Garfield, Damascus, Salem and Lisbon. The western portion of the system will be under the control of the Stark County Railway Company, while the eastern section will be operated by the Alliance, Sebring & Salem Electric Railway Company.

MR. H. A. EVERETT, president of the United States Telephone Company, of Cleveland, which controls the independent lines of Ohio, denies the recently published statement that the United States Company had combined with the independent companies of Illinois, Indiana and Michigan to oppose the old companies. He states that these mentioned have entered into an agreement for the interchange of business, but have not amalgamated under one management. Mr. Everett states that the rates on all lines of the United States Telephone Company will be greatly reduced; also that the Cuyahoga County Telephone Company, of which he is also at the head, will cut the present rates for Cleveland in two. The last mentioned company has a franchise to operate throughout Cleveland, and is rapidly putting in lines.

INDIANA NOTES.

GAS EXPLOSION.—An explosion of natural gas under the boilers in the power house of the Muncie Street Railway Company, on June 22, caused considerable damage.

STOCK PLACED.—The Home Telephone Company, of Richmond, which is now constructing its system, announces that its issue of $100,000 bonds has all been taken, and that there is no stock on the market.

A 60-MILE ELECTRIC RAILWAY PROJECTED.—The Springfield Street Railway Company has decided to build an electric line from Springfield to Hillsboro, by the way of Cedarville and Jamestown. The road will be about 60 miles long.

IRVINGTON-KNIGHTSTOWN CONTRACT LET.—The contract for the construction of the electric railway from Irvington to Knightstown, via Greenfield, was let on June 23, to the Greenfield Construction Company. The section between Irvington and Greenfield will be the first built, and will be in operation by fall, and will come into Indianapolis on the local company's line.

A TELEPHONE WAR.—The Central Union Telephone Company, failing in its purpose to buy the local exchange at Greenfield, offering $10,000 therefor, is circulating a petition to secure subscribers to a new telephone exchange, which will connect with the Central Union lines at Indianapolis and other Indiana cities and its long distance connections. This move will, it is thought, precipitate a telephone war at Greenfield.

ELECTRIC RAILROAD COMPANY INCORPORATED.—The Muncie, Anderson & Indianapolis Street Railroad Company has filed articles of incorporation with the Secretary of State, with a capital stock of $2,000,000. The directors of the company are G. F. McCullough, W. C. Sampson, C. L. Henry, E. C. Carpenter and J. A. Van Osdal. The articles state that an electric road will be built from Muncie to Anderson and thence to Pendleton, Fortville, Middletown and Indianapolis.

NEW GENERAL MANAGER.—The Boston capitalists, Messrs. Lee, Higginson & Co. and Stone & Webster, who secured control of the Terre Haute street railway plant, have selected Mr. Guy E. Tripp, of Boston, as general manager. The old employees will generally be retained, and the working force will not be materially altered. The company has been reincorporated under the name of the Terre Haute Electric Company. The new directors are: J. T. Beasley, J. G. McNutt, W. R. McKean, Demas Dennig and John E. Lamb. Mr. Tripp contemplates extending the lines within the city, and promises to begin the construction of the Brazil interurban line at once.

A NEW TELEPHONE SCHEME.—The managers of the Central Union Telephone Company, in Wabash, Ind., and adjoining counties are trying to interest the farmers in a scheme to secure cheap rural service. They propose to have farmers in a wide area organize and build the lines, establish a central station at one of the residences, and employ a lineman to keep the lines in repair. The Bell people will rent the long distance instruments at $5 per year each, and for a trifle first-class exchange service could be supplied. If the farmers wish to connect with a county seat, they can run a line to the city, and at a small outlay for each conversation use the city lines. In case the farmers do not care to build the rural lines themselves, the Central Union, if a contract for a reasonable period is made, will put in the toll lines and charge for the use of the lines and the instruments. The proposition is regarded favorably by the farmers, and it is predicted that before the end of another year few substantial landowners in this vicinity will be without telephones.

CHICAGO NOTES.

THE CHICAGO TELEPHONE COMPANY has purchased a lot on the west side of Union Avenue, on which it proposes to construct a fireproof telephone exchange. The building will be three stories high, of pressed brick, and will cost about $30,000. The plant and equipment will involve a total outlay of $125,000.

MESSRS. FORTUNE BROS., 225 Des Plaines Street, Chicago, have placed an order with the Western Electric Company to equip their buildings with an electric light plant. All of the material will be of Western Electric manufacture, and the work will be installed by the construction department of that company.

AN UNDERGROUND RAILWAY.—An ordinance has been introduced in the City Council asking for a 94-year franchise to be given to the Chicago Subway, Arcade & Traction Company. This company, it is said, has a capital stock of $250,000,000, and is backed by the same New York capitalists who recently acquired Mr. Yerkes' street railway interests here. The ordinance provides for an electric railway system to traverse the city, more than 25 feet underneath the surface of the principal streets. Cars will be carried through a tunnel 18 feet wide and 13 feet high. The company offers to give the city what amounts to 5 per cent. of its net receipts and an option for municipal ownership at the end of 30 years. The construction of the tunnel, its stairways and approaches will be of an ornamental character. The city is also to have the right to use the tunnel as a conduit for its electric wires.

MR. E. H. BALL, secretary, treasurer and general manager of the Chicago Belting Company, made a business trip to the south recently in the interest of his company. His visit was eminently successful, judging from the orders he brought back. The business of this company has been increasing so rapidly of late that it has been compelled to run its factory to its utmost capacity. Mr. Ball recently secured for his company the services of Mr. B. F. Horsting, favorably known in the belt business as secretary and treasurer of the old Munson Belting Company. Mr. J. H. Shay, who was so long with the Munson Company, has also gone with the Chicago Belting Company, as already noted in these columns. Another man Mr. Ball has secured for his company is George Conger, who had charge of the Chicago factory of the Munson Company. The Chicago Belting Company is one of Chicago's progressive concerns and the success with which it is meeting is well merited.

STORAGE BATTERIES FOR AUTOMOBILES.—Mr. J. K. Pumpelly, of this city, has recently been granted patents on improvements in storage batteries. He uses lead jars, and, with other modifications, he states he can make batteries at greatly reduced cost. The lead cells weigh two pounds more than rubber cells, but this additional weight is compensated for. He has just finished a set of 44 cells for automobile work, which complete, ready for use, weigh 900 pounds. It is calculated that they will drive a vehicle 60 miles. The plates are said to have great endurance. The active material weighs more than the lead support. Mr. Pumpelly is one of the pioneers in this line of work, having been engaged in the storage battery business since 1888. Mr. Porter, who is associated with Mr. Pumpelly, is also an old-timer, and the two gentlemen have made many improvements in storage batteries.

WISCONSIN NOTES.

THE FOND DU LAC STREET RAILWAY & ELECTRIC COMPANY opened its line to the public on June 25.

THE MILWAUKEE RAILWAY block signal system, operated by telegraphers, has been placed at all the important crossings of the line in this city, and will be in regular operation day and night.

VOTED FOR A MUNICIPAL PLANT.—Oconomowoc recently held a special election, and about eight-ninths of the votes were in favor of purchasing the local electric light plant and issuing electric light bonds.

THE FORMAL OPENING, on July 10, of the Chicago & Milwaukee Electric Railway will make it possible for a person to start from Hammond, Ind., or Blue Island, Ill., and ride in electric cars all the way to Waukegan, and this journey of fifty miles may be extended to Milwaukee, as soon as a gap of about fifteen miles is filled in, connecting the Milwaukee, Racine & Kenosha electric line, running from Waukegan to Kenosha.

THE MILWAUKEE ELECTRIC COMPANY, 296-298 Reed Street, has its shop fairly completed. It has been busy getting out a machine of each size it proposes to manufacture, and so far has about six sizes completed. It will manufacture for the present the following sizes: Slow speed, 1-hp to 20-hp; medium speed, 1½-hp to 30-hp. The machines are of the four-pole type, and so constructed as to be used on floor, wall or ceiling. The company states that it has encouraging prospects for a rushing business.

OSHKOSH.—The committee of the Board of Trade of this city, which has the matter of inducing the promoters of the electric railroad line from Stevens Point to build to this city, met with the promoters June 23, and were given three propositions to work upon. The promoters want a tract of land sufficient for terminal purposes. This includes depot, grounds, car-shop grounds, switch yards and sites for necessary freight warehouses. The second proposition is for the city to raise money enough, and give it to the promoters to make the purchase of the land, or a third proposition, for the city to raise bonds, to be taken by the promoters to be negotiated. The question is now in the hands of the committee. It will investigate and report upon which of the propositions to accept.

ST. LOUIS NOTES.

EXTENDED TELEPHONE SERVICE.—The Bell Telephone Company has plans under way to extend its telephone service to various points in this neighborhood.

ALTON LIGHTING PLANT.—The mayor has signed the ordinance passed by the Alton City Council granting a franchise for the construction of an electric light plant, to Walter L. Waples and George R. McMillan. These gentlemen say they will construct a complete heat, power and light plant at once, using it for commercial purposes.

TO MERGE POWER HOUSES.—The Missouri Railway Company has secured a permit for the erection of a large building in connection with the Lindell power house at Park and Vandeventer Avenues. The building will be one story high, 114 by 155 feet. It is to cost about $60,000. This means the merging of the power houses of all lines into two, one of which is to be at the location mentioned above and will supply half of the entire St. Louis system.

ANOTHER SUBURBAN RAILWAY.—The Illinois & Mississippi Valley Terminal Railway Company, with headquarters at Alton, Ill., and a capital stock of $100,000, was licensed last week to incorporate. The road will run from Alton to Edwardsville, East Alton, Granite City, in Madison County; East St. Louis, O'Fallon, Belleville and Carondelet in St. Clair County. The incorporators and first Board of Directors are William Elliott Smith, George W. Lewis, Charles Lewis, R. H. Lewis and Harry Ferguson, of Alton. The purpose is to operate cars by electricity.

ELECTRIC BELT LINE.—The County Court of St. Louis County, at Clayton, has reconsidered its action of a few days ago when at a special session it granted a blanket franchise for a belt electric railway line around the city from Jefferson Barracks on the south to Chain of Rocks on the north, to Harry E. Wagoner, James C. Jones and Ackman Welch, of St. Louis. It is claimed that the indefinite description of the proposed route, the unrestrained use of the county roads, the length of time given the promoters in which to complete the line, and lastly the fact that the promoters are not known in the county, and not incorporated as a railroad company, and that they, or whoever they represent, give the court no guarantee of their good faith and purpose or their ability to construct and operate the line.

FINAL PAYMENTS MADE.—The final payments on the Lindell and Missouri street railway systems were made last week by Messrs. Brown Bros. & Co., of New York. The various lines of these systems were purchased several months ago by the syndicate and a first payment of $30 a share was made at the time. The price paid for the Missouri lines was a little over $192 a share. For the Lindell lines $170 a share was paid. Payments for the Lindell stock were made last week. The total amount due on this stock was $3,360,000—2400 shares at $140 per share. The amount due on the Missouri stock was $3,729,450—23,000 shares at $162.15 a share. Messrs. Brown Bros. are now sole owners of the two systems. The final payments on the Union Depot system are due on or before July 1. Final payments on the People's line are not due until fall.

PACIFIC COAST NOTES.

THE SAN FRANCISCO FIRE AND POLICE TELEGRAPH SYSTEM, William R. Hewitt, superintendent, recently commenced laying underground mains on Third Street, in accordance with the policy of putting the wires under ground as soon as practicable.

THE SUNSET TELEPHONE & TELEGRAPH COMPANY recently commenced building a new telephone line from Chehalis, Wash., to South Bend, a distance of about 60 miles. There will be way stations at Adria, Dryard, Pe Ell, Frances, Holcomb, Willapa and Menlo.

ELECTRIC POWER FOR THE COMSTOCK MINES.—It is probable that an attempt will be made to utilize the water flowing from Donner Lake, Nev., to supply electric power for the Comstock Mines, as the distance is not very great. The lake is on the property of the Sharon estate, and negotiations have been proposed for the use of the water right.

CANADIAN NOTES.

THE LUNEN GAS COMPANY, of Lunenburg, Nova Scotia, has changed its lighting system from direct current by steam to alternating current by water power, and is offering for sale its direct current plant.

THE MONTREAL & SOUTHERN COUNTIES ELECTRIC RAILWAY COMPANY has had surveyors employed at work for some time on the south side of the St. Lawrence, laying out routes. The company is now about to commence work on the first section of its system to connect, for the present, with the Grand Trunk Railway at St. Lambert.

THE ANNUAL MEETING of the Ottawa Electric Light Company was held on June 26. The annual report of the directors stated that the revenue from all sources for the past year was $161,615, and there was a surplus of $48,246. The total value of the plant of the company is placed at $1,209,438. The revenue was much larger than last year, despite the fact that the price of electric light was lowered 20 per cent. The number of incandescent lights now supplied to Ottawa by this company alone is 77,255, together with 621 arc lights, 23 heaters and 103 motors.

THE ROYAL ELECTRIC COMPANY, of Montreal, Quebec, is now using the water power of the Richelieu River at Chambly. The work, which has been going on for more than two years, has just been completed. In anticipation of this, the company has for some time been making contracts at a substantial decrease over the old rates. The undertaking is said to be one of the largest and best of its kind, not alone in Canada, but of the entire world. The character of the machinery throughout is of the most modern and advanced type. It has been the common idea that the electrical machines at Niagara are the largest, but now, not only has Montreal the largest machines, but they were also made in the local shops of the Royal Electric Company. The company proposes, before operating the water power continually to serve the requirements of Montreal, to subject the entire works at Chambly, the connecting lines and the receiving apparatus in the city to the utmost possible test, and will occupy the next few weeks in the work of testing. An illustrated description of this plant was published in THE ELECTRICAL WORLD AND ENGINEER, June 3.

General News.

THE TELEGRAPH AND TELEPHONE.

FRANKFORT, KY.—Incorporation papers have been filed by the Owingsville Telephone Company, of Bath County. The capital stock of the company is fixed at $2500. The service will be local only.

BELL TELEPHONE.—The net output of Bell telephones for the month ended June 20 was 45,731 instruments, as compared with 14,321 in 1898. The net output since Dec. 20 is 249,289, and the total outstanding is 1,374,539.

SALEM, OHIO.—The Columbiana County Telephone Company has been organized to operate a telephone system. The capital stock is $200,000. The incorporators are S. C. Thayer, W. D. McKeefrey, G. S. Walters, W. C. Morrow and M. S. Hawkins, all of Salem.

HAMILTON, OHIO.—The American District Telegraph Company has been organized here to do a messenger service business. The capital stock is $10,000. The incorporators are I. H. Miller, A. B. Clark, R. E. Miller, L. A. Iveton and C. E. Page, all of Hamilton.

PEORIA, ILL.—The Brimfield Telephone Company has filed incorporation papers. The capital stock of the company is $500, and the board of directors includes the following named gentlemen: C. F. Dungan, A. A. Knapp, J. H. Carson, W. L. Wiley and H. O. Cady.

JERSEY CITY, N. J.—The United States Telephone Company has been incorporated in New Jersey. The purpose of the company is to manufacture electrical apparatus of all kinds. The capital stock is $125,000, and the incorporators are Oscar L. Lefferts, Oscar A. Enholm and John W. Hutchinson, Jr.

ELIZABETH, PA.—The Elizabeth Telephone Company has been incorpo-

rated to conduct a telephone and telegraph business. The capital stock is $5000, and the incorporators are E. P. Van Kirk; W. P. Wylie, A. F. Peaire, A. D. Pierce and A. J. Walker, all of Elizabeth.

MILLERSBURG, PA.—The Susquehanna Telephone & Telegraph Company has been organized here, with a capital stock of $5,000. The incorporators are J. E. Kahler, F. W. Lenker, of Killinger; E. H. Leffler, J. H. Rowe, M. Ulrich, of Millersburg; E. E. Koppenhaver, H. M. Bonawitz, G. M. Lenker, of Rife, Pa.

JOLIET, ILL.—The Northwestern Telephone Company has been granted a 25-year franchise in this city. The company will operate in competition with the Chicago Telephone Company here. It will pay the city $1 a year for each telephone, the mininum sum being $500. All of the city departments are to receive free service.

NEW HAVEN, CONN.—The Southern New England Telephone Company has made another reduction of rates between places in this state not exceeding about 12 miles apart. The former rate of 25 cents for five minutes' conversation during the day has been reduced to 15 cents. The rates for longer distances remain unchanged.

BLOUNTSVILLE, TENN.—The Holston Telephone Company has been organized here and incorporated under the Tennessee laws. The object of the company, which has a capital stock of $1000, is to construct and operate a telephone system. The incorporators are J. C. Henry, J. B. Wolf, E. E. Wolf, E. J. Burkey, W. C. Webb, all of Blountsville.

ALBANY, N. Y.—Articles of incorporation of the Glen Telephone Company of Montgomery County, with a capital stock of $10,000, have been filed with the Secretary of State. The company's headquarters will be in Glen. The directors are J. S. Glen Edwards, A. Marshall Burt, A. Andrew Turnbbul, Jacob W. Shelp, Edward Edwards, of Glen; Howard A. De Graff, of Fonda, and Edward C. Evans, of New York.

WORCESTER, MASS.—The Worcester Telephone Company has filed a certificate of incorporation, with a capital stock of $200,000. The purpose of the organization is to buy or otherwise acquire, construct, lease and operate telephone and telegraph lines within the State of Massachusetts. The officers are Henry F. Harris, president; William P. Searles, treasurer, and these two with Henry S. Pratt constitute the directorate.

MANCHESTER, N. H.—The stockholders of the new telephone line to be built between this city and Salisbury, have perfected their organization and the company has been styled the Kearsarge Telephone Company. The general management of the company will, for the present, be in the hands of Messrs. William W. Burbank, Frank Dunlap and E. N. Sawyer, of Salisbury; G. H. Davis, of Tilton, and Charles S. Foote, of Penacook.

SYRACUSE, N. Y.—The Syracuse Telephone Company has been organized to construct a telephone line to all points in Onondaga County, including the City of Syracuse. The capital stock is $450,000. The incorporators are J. J. Jermyn, John L. Wentz, and Frank H. Jermyn, Scranton, Pa.; George C. Wentz, Drifton, Pa.; Edward Barneman, Ernest L. White, Manning C. Palmer, Arthur R. Peck and H. W. Plumb, Syracuse.

SALINA, KAN.—The Kansas & Missouri Telephone Company is making preparations for extensive improvements and expansion in Kansas during the summer. It will extend its lines from Paola to Fort Scott and thence to Iola. Another line will be built from Emporia to Newton. A line will be constructed from Wichita to Augusta and thence to Eldorado, and other lines will be built from Wellington to Harper and Anthony; from Saline to Hutchinson and from Abilene to Minneapolis, Lincoln and Beloit.

PITTSBURG, PA.—The Central District & Printing Telegraph Company states that it has orders for over 1000 telephones which it cannot fill. The demand for instruments comes from all parts of the district covered by the company's service. The Central Company has been steadily growing during the past few years and its inability at the present time to meet the demand for telephones is stated to be due to the crowding of orders with the wire and electrical apparatus manufacturers, who are unable to keep up with the demand.

NEW BEDFORD, MASS.—The Board of Public Works has granted a franchise to the Automatic Telephone Company of New Bedford, with $100,000 capital. The officers are: President, F. T. Akin, of F. T. Akin & Co.; treasurer, Frederic Taber, president New Bedford Safe Deposit & Trust Company; clerk, A. E. Perry, of Knowlton & Perry. The Strowger Automatic Telephone system will be used. This was investigated by Mayor C. S. Ashley and Samuel C. Hunt, who went as far as Augusta, Ga., to see the actual working of the system. The company is authorized to put its wires both under ground and overhead. The engineering work will commence at once. Between 400 and 500 subscribers have been secured.

NEW ENGLAND TELEPHONES.—There seems little doubt that the telephone consolidation in Massachusetts, by which the New England Telephone & Telegraph Company will absorb the Southern Massachusetts Telephone Company, will soon reach a successful culmination. President Sherwin, of the New England Company, does not deny that negotiations are under way, but said he could give no details about it at present. The Southern Massachusetts Company operates under Bell patents in New Bedford, Fall River, Taunton and contiguous territory. It is believed in telephone circles that the New England Company is seeking to connect the entire telephone business of New England, and will in time secure control of the Providence and Southern New England Companies. The present purchase will give to the New England Company control of the entire telephone business of New England, with the exception of Rhode Island and Connecticut territory. The company offers to the Southern Massachusetts stockholders four shares of its stock for every three shares of Southern Massachusetts. It is thought that the deal will be fully consummated in a few days.

ELECTRIC LIGHT AND POWER.

SPENCER, MASS.—The Citizens' Gas & Electric Light Company has been organized here, with a capital stock of $60,000. The officers are Erastus Jones, president; F. A. Drury, treasurer.

CHELSEA, VT.—The Chelsea Electric Light & Power Company has been incorporated, with a capital stock of $10,000, by W. F. Davis, E. D. Burnes, Viola Davis, Chelsea; H. M. Dufur, Waterbury; C. F. Smith, Topsham.

FORD CITY, PA.—The Ford City Electric Light, Heat & Power Company has been organized, with a capital stock of $1000. The incorporators are W. G. Heiner, Kittanning; A. Greenbaum, R. Nysmith, W. H. Schaefer and P. F. Moss, Fort City.

OMAHA, NEB.—It is stated that the building of a large power plant for the purpose of supplying this city with electric power at low cost is in contemplation. General B. N. King, of Dayton, Ohio, is associated with a number of New York and London capitalists in the enterprise.

DUBOIS, PA.—The Dubois Electric Company has been chartered in Harrisburg to supply light, heat and power. The capital stock is $42,000, and the incorporators are J. E. Dubois, F. W. Hetfield, W. Osborn, M. I. McCreigh, W. C. Pentz, all of Dubois, and S. W. Robinson, of Punxsutawney.

EAST RADFORD, VA.—The Radford Electric Light & Power Company's plant has been sold to Mr. George L. Carter, president of the Virginia Iron, Coal & Coke Company. Mr. Carter also purchased a five-years' lease of the electric railway plant. He will place the property in good running order.

CAVENDISH, VT.—The Vermont Electric Light & Power Company has been organized here, with a capital stock of $100,000. The company will erect a dam across Black River. The incorporators are E. G. White, C. E. Ongley Nellie E. Whitcomb, Nellie C. White and C. W. Whitcomb, all of Cavendish.

ALBANY, N. Y.—Superintendent Partridge, of the State Department, has granted the application of the Hudson River Power Transmission Co. for permission to erect poles and string wires on the berme bank of the canal between Mechanicville and Albany, a distance of 20 miles. The company will furnish electricity for lighting and power purposes.

MINNEAPOLIS, MINN.—The Minneapolis Electric Light & Power Company has filed a petition for dissolution. The company had a capital stock of $50,000, all issued. For the past five years it has transacted no business except to transfer certain shares to the Minneapolis General Electric Company, which it held, and to order a distribution of the proceeds.

UTICA, N. Y.—The Utica Electric Light Company, the Utica Electric Manufacturing & Supply Company and the Trenton Falls Electric Light & Power Company. The operations of the company will be in the cities of Utica and Rome, and in Oneida and Herkimer Counties. The capital stock is $1,000,000, and the directors are Joseph Fox, of New York; William G. Phelps, of Binghamton, and Henry D. Pixley, Daniel N. Crouse, T. S. Griffiths, M. J. Brayton and William E. Lewis, of Utica.

NEW ORLEANS, LA.—The new power house of the Merchants' Electric Light & Power Company will be a thoroughly modern structure and will be equipped with best apparatus. The Western Electric Company, of Chicago, has the contract for the electrical equipment. The building will be fireproof. The boilers will be of 1500-hp. There will be two Stanley generators of 600-hp each and one of 300-hp. These will supply an alternating current which will be conveyed to a substation, where it will be converted into direct current by means of rotary converters.

THE ELECTRIC RAILWAY.

YOUNGSTOWN, OHIO.—The Mahoning Valley Traction Company has been incorporated to build and operate an electric railway. The capital stock is $10,000, and the incorporators are C. E. Sanders, C. C. Owens, W. B. Whiting, A. M. Snyder, W. M. Duncan, all of Youngstown.

MARSHALL, MICH.—The dam at Ceresco will be raised 14 feet and an electric plant will be established there to furnish power for the Battle Creek, Kalamazoo & Gull Lake Electric Railway. Mr. C. P. Frisbee, promoter of the Kalamazoo River Electric Company, is interested in the enterprise.

NEW YORK, N. Y.—The Manhattan Elevated Railway Company, it is stated, is contemplating the extension of its lines toward Fordham, in Bronx Borough, with the probability of further extension in the near future to the territory lying north of that place. In line with this work the railway company recently acquired some property in that section of the city to be used as a terminal.

WHEELING, W. VA.—The strike of the employees of the Wheeling Railway Company, which was begun two months ago, was settled on June 24. The men struck for 20 cents an hour and nine hours per day. They went back to work on the basis of 18 cents an hour, with eleven hours constituting a day's work. The strike cost the city, the men and the company several hundred thousand dollars. It was at first characterized by much disorder, which was stopped, in a measure, by an injunction issued by the United States Court. About $100,000 worth of damage suit cases against the company have been filed for personal injuries alleged to have been caused by the employment of new men as motormen.

PERSONAL.

MR. J. B. BRAITHWAITE, chairman and managing director of the Brush Engineering Company, of England, is on a visit to this country, and is now making a trip in the Far West.

MR. L. J. STEELE, electrical engineer of Verity's, Limited, of England, is making a professional tour of the United States as far as the Rockies, and including Canada. He has been greatly interested in the work at Canada.

MR. JOHN W. MACKAY has caused a notice to be given out flatly contradicting the report that he is in any way interested in or sponsor for independent telephone work now being pushed in some of the Western States.

MR. A. E. LEVIN, at one time connected with Brown, Boveri & Co., of Switzerland, and an associate member of the English Institution of Electrical Engineers, is visiting the United States and inspecting some of the larger plants.

MR. SAMUEL INSULL has been a visitor to New York the past week. He has fairly well recovered from his injuries caused by a runaway cab horse, but the accident might have been very serious. As it was, Mr. Insull was cut and bruised from head to feet.

MR. V. KISKEVICH, electrical engineer of the Russian-Chinese Eastern Railway, with Mr. V. Kashevnikoff, of Charbin, Manchuria, its chief engineer, has been in New York and other cities buying a large quantity of railway supplies and machine tools.

SIR W. H. PREECE has now had the freedom of the Borough of Carnavon conferred on him. The old town is his birthplace. The honor thus bestowed is probably unique for an engineer, and goes usually to celebrated soldiers and sailors after a victory. Sir William has well earned the high distinction all the same.

MR. J. J. NATE, of the Standard Telephone & Electric Company, of Madison, Wis., has availed himself of a little leisure to make a trip East, spending part of last week in New York. He speaks most hopefully of the independent telephone movement, and estimates the number of "opposition" exchanges at not far short of 3000. His company has equipped a great many of them.

MR. J. DE CORDOVA, editor and publisher of the *Daily Gleaner*, of Kingston, Jamaica, West Indies, has been making a study of the electric railroads in this country. An idea is afoot that it might be well to utilize some of the water powers of the island in operating the whole or part of the present steam railway system. Considerable expenditure would be involved if the plan were feasible.

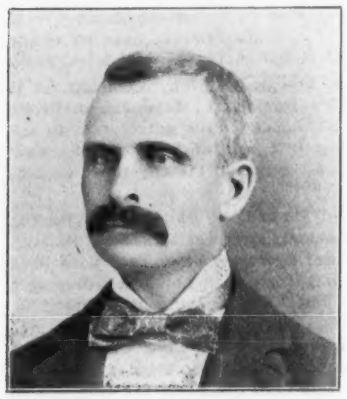
SPRAGUE ELECTRIC COMPANY.—A very important change has occurred in the personnel of the Sprague Company, Mr. E. H. Johnson having cabled from Europe his resignation as vice-president and general manager, as he intends staying there for some time. In his place Mr. John E. Searles, formerly one of the sugar magnates, president of the American Cotton Company and vice-president of the International Trust Company, has been elected vice-president, with the idea that he shall give active attention to the affairs of the corporation. President Chandler has retired to his home in Vermont, seriously ill from overwork, so that a large amount of responsibility falls to Mr. Searles' share at this juncture.

LEGAL.

A NEW YORK SUBWAY SUIT.—A suit was begun last week in the New York Supreme Court by service summons to prevent the Metropolitan Railway Company from using electricity carried through conduits along its surface railway tracks for any purpose other than operating its cars. The suit is brought in the name of William H. Reiger through his lawyers, James, Schell & Elkus. As a matter of fact it is said to be a phase of the struggle between the Standard Oil on one side and the Whitney-Brady-Elkins-Widener syndicate on the other. The Metropolitan had practically consummated a lease to the New York Heat, Light & Power Company, by which the latter would pay to the Metropolitan $1,000,000 a year for surplus electricity and the use of the conduits. The Consolidated Gas Company is said to be behind the suit.

OBITUARY.

GILBERT H. BLODGETT, secretary and general manager of the Mason Telephone Pay Station Company, died at his residence in Ludington, Mich., Wednesday evening, June 21, aged 43 years. Mr. Blodgett has for many years been one of the leading attorneys of northwestern Michigan, and continued the practice of his profession up to the time of his death. Less than a year ago he became interested in the Mason Company as a stockholder and soon afterward was elected to the position which he held at the time of his death, and, although unable to give his entire attention to the management of the concern, his energy and up-to-date business methods have done much to place the company on a permanent business basis. In his death the Mason Telephone Pay Station Company loses one of its strongest men. His knowledge of telephone affairs, coupled with his legal attainments, enabled him to direct the affairs of the company with the certainty that comes only from large experience and business capacity. Deceased had a large circle of acquaintances, who will mourn his death.



THE LATE G. H. BLODGETT.

Trade and Industrial Notes.

THE ZIEGLER ELECTRIC COMPANY, 141 Franklin Street, Boston, Mass., reports that it is enjoying large sales of its voltmeter. This instrument has become quite popular. It is guaranteed to be reliable and accurate.

ARMOUR & CO., Chicago, Ill., after having made a thorough three-months' competitive test of twelve makes of alternating inclosed arc lamps, awarded the contract to Gates & Randolph, Chicago, for 200 Sterling lamps on the points of best light, least noise, easiest trimmed, longest life.

THE BROWN ELECTRIC COMPANY, of Little Rock, Ark., has filed articles of incorporation. The company proposes to carry on an electrical business. Its capital stock is $30,000, and its officers are George M. Heard, president; W. M. Kavanaugh, vice-president; Milton Hill, secretary and treasurer.

THE LESCHEN-MACOMBER-WHYTE COMPANY, Chicago, reports a remarkable increase in business. It has just received the following large orders from Wisconsin that were shipped within six hours after receipt of same: 10,000 feet of galvanized strand and five miles of galvanized guy clamps and weatherproof wire.

THE MANHATTAN GENERAL CONSTRUCTION COMPANY, manufacturer of the Manhattan enclosed arc lamps, has removed to its new factory at Plane and Orange Streets, Newark, N. J., where its general offices are also located. The Manhattan Company, however, retains a sales office at its old address, Room No. 814, Bowling Green Building, No. 11 Broadway, New York.

THE CLEVELAND TWIST DRILL COMPANY, Cleveland, Ohio, is building a large power plant which will be equipped with the most modern boilers, engines, stokers, coal and handling conveyors and a complete electrical equipment. The company is equipping its plant with electric motors. The irregular form of the factory plant renders the use of electric power more economical than any other.

THE RARITAN ELECTRIC MFG. COMPANY, has been incorporated at New Brunswick, N. J. This company is the successor of the Beacon Lamp Company. It is capitalized at $150,000, half of which is preferred stock, paying a guaranteed dividend of 7 per cent. annually. The incorporators, all of whom are residents of New York City, are Albert H. Gleason, Herbert Watriss and W. Russell Osborn. As we go to press it is reported that the factory has been destroyed by fire.

THE SIEMENS & HALSKE ELECTRIC COMPANY, Chicago, Ill., states that the recent report to the effect that it would devote its factory to the exclusive manufacture of automobile motors is erroneous. The company is manufacturing electrical apparatus of all kinds—railway generators, motors, alternating apparatus, transformers, meters, arc apparatus, etc., and all orders will receive the best of attention.

NEW ZEALAND.—The Council of Rangitikei County, New Zealand, has placed an order with the Berlin Iron Bridge Company, of East Berlin, Conn., for a highway bridge, consisting of a single span of 204 feet, designed to carry a distributed load of 1500 pounds per lineal foot, or a road engine weighing 40 tons. The bridge will be a pin-connected structure on account of the ease and facility with which this class of work can be erected in the field.

MESSRS. J. B. COLT & CO., New York, whose "Criterion" acetylene gas generators are used and indorsed by the United States Government, have recently received some substantial orders from Uncle Sam for acetylene searchlights for the Signal Service. This apparatus was first tested by the Government experts during the late Cuban war, and signaling was successfully done at a distance of 45 miles at night, far surpassing in general efficiency, it is claimed, anything of that nature heretofore used.

THE ELECTRIC APPLIANCE COMPANY, 92 and 94 West Van Buren Street, Chicago, is making a special point of the fact that it is manufacturing its own telephones. It felt from the beginning of the independent telephone business that it wanted to have only the best apparatus, and to be absolutely sure that it should get the best it has been manufacturing its own goods with the greatest possible care. The large volume of its business indicates very clearly the wisdom of the policy the company has followed up in this matter.

TROTTER'S MONA COMMUTATOR COMPOUND, manufactured by the Mona Manufacturing Company, 65 West Broadway, New York, is claimed to be the most efficient lubricator for carbon, leaf or gauze wire brushes, and is said to be used by many of the largest and most important electric plants in the United States and Germany; also in Canada, England, France, Russia, Italy, New Zealand, Queensland and in nearly every part of the civilized world. A sample will be sent free by addressing Messrs. Goldmark & Wallace, 121 Worth Street, New York City.

THE FISCHER EQUIPMENT COMPANY, of Chicago, has received an order from Frederick Loeser & Co., of Brooklyn, N. Y., for a number of automobile delivery wagons, to be finished at the earliest possible moment. This is the first order of the kind for Brooklyn, it is believed, received by builders of electric vehicles. Frederick Loeser & Co. believe the crude experimental stage of the self-propelled carriage to have passed, and have not hesitated to back their faith by investing a large sum in harnessing the new convenience to their up-to-date system of doing business.

ELECTROSE TELEPHONE CASES.—For the last seven years, Electrose has been before the public as a cheap and wholly adequate substitute for hard rubber, and it was never more popular than now. At the present moment the Electrose Manufacturing Company, of 123 to 137 North Tenth Street, Brooklyn, N. Y., are putting upon the market in addition to their celebrated line of telephone specialties, in the shape of the new Electrose double-pole, Bell style, receiver case. It has already met with a most favorable reception at the hands of the best judges and rounds out the list of telephonic specialties most admirably. Mr. Louis Steinberger, the president of the company, reports an excellent business in the various lines of work to which Electrose has been applied. The company will welcome any inquiries for samples, prices, etc.

THE UNION BOILER TUBE CLEANER COMPANY, 258 Penn Avenue, Pittsburg, Pa., was organized in 1895, for the purpose of introducing a new method of removing scale from the interior of the tubes of water tube boilers. By the use of its apparatus, the company is enabled to contract for the thorough cleaning of boilers under a time limit, with bond for heavy penalty for nonfulfilment. The company also sells or leases the tools for cleaning all makes of water-tube boilers having straight, horizontally-inclined or vertical tubes, and those having curved tubes, such as the Climax and Sterling boilers, also the Hazleton, which has closed end tubes. It is stated that the latter cannot be cleaned in any other way except by the use of this company's devices. These cleaners have been adopted by many of the largest concerns in the United States and England. The saving of fuel, as well as the increase of the efficiency of boilers by their use is now pretty well known to steam users. The

company started with a well-equipped factory, but so great has been the demand for these cleaners that it has been found necessary to frequently enlarge its works and increase its force in order to keep up with the orders. The company has a flexible shaft which is unique in its way. This shaft is the result of the necessity for a device to clean boilers having curved or other tubes inaccessible to a stiff rod.

THE WESTERN ELECTRIC COMPANY has filed plans for the erection of a ten-story fire-proof factory building, 106x143 feet, on Washington and Bank Streets, New York city. It is stated that the improvements will cost about $500,000.

FORT WAYNE ELECTRIC WORKS.—The office of the Fort Wayne Electric Works for West Virginia, Western Pennsylvania and Eastern Ohio is now located at 902 Fifth Avenue, Pittsburg, Pa. Mr. J. E. Hall has been placed in charge.

THE CHASE ELECTRIC SIGN COMPANY, of Chicago, Ill., has been organized with a capital stock of $10,000. The company will manufacture electrical letters, signs, emblems and accessories. The incorporators are Charles A. Chase, K. P. Peck and A. B. Wilson.

THE ELECTRICAL ASSOCIATION has been organized in Portland, Me., to manufacture and deal in electrical plants. The capital stock is $300,000, and the incorporators are C. H. Newhall, J. S. Bartlett, M. P. Clough, of Lynn; R. P. Clapp, Lexington; C. H. Talman, Portland.

ALTERNATING CURRENT LIGHTNING ARRESTER.—Bulletin 104, issued by the Western Electric Company, describes the S. K. C. alternating current lightning arrester, and gives some valuable information regarding the S. K. C. line discharger. A copy of this bulletin will be mailed upon request.

THE GAS AND ELECTRIC APPLIANCE COMPANY, of Trenton, N. J., has been incorporated to deal in electrical appliances. Its headquarters are at 219 East State Street, Trenton, N. J. The capital stock is $10,000. The company was incorporated by Fred P. Auten, Theodore Backus, Henry McMillan, all of Trenton.

THE BOSTON ELECTRIC SWITCH COMPANY, of Portland, Me., has been organized to manufacture a railway switch. Its capital stock is $50,000, and the officers are: R. T. Johnson, of Quincy, president; A. F. Macleod, of Quincy, treasurer; H. W. Sprague and William F. Stedman, also of Quincy, are among the incorporators.

AMERICAN FIRE ENGINE COMPANY, Seneca Falls, N. Y., report that they have recently booked orders for a 6x6, a 9x9 and two 7 and 12x6 cross compound Shepherd automatic engines. These latter, placed through Burhorn & Granger, of New York City, are to be direct connected to C & C generators and installed on board the U. S. man-of-war "Cincinnati."

MESSRS. CHARLES WIRT & CO., 1028 Filbert street, Philadelphia, Pa., have just issued two new circulars, in which are listed and illustrated dynamo field rheostats and theatre dimmers. They are advance sheets of catalogue A. In each circular a concise description is given of the apparatus, together with complete price lists, dimensions and code words of the various sizes and styles.

MR. WILLIAM ROCHE, 42 Vesey street, New York, manufacturer of the New Standard dry batteries, states that during the first four days of last week he booked orders for over 1700 No. 2 cells. He looks upon this order as an indication that there is a feeling somewhere that the "New Standard" does all that he claims for it, and a little more. He is expecting some large export orders in the near future.

PRESIDENT W. R. FLEMING, of the Harrisburg Foundry & Machine Works, Harrisburg, Pa., reports that the company has been running day and night for the past ten months, and owing to the crowded state of the establishment has refused many otherwise attractive contracts. At present it is getting work done in four separate shops to keep up with the orders on hand, and its output is three times greater than it was in 1897. Mr. Fleming has not been loafing.

THE CROCKER-WHEELER COMPANY, New York, has just brought out a neat brochure on the subject of electricity for printers. It is being distributed in the printing trade, its object being to point out a few of the peculiar advantages possessed by electric motors for driving printing machinery. The Exposition booklet, issued by the Crocker-Wheeler Company during the electrical show at Madison Square Garden last May, is being mailed to manufacturers.

THE BERLIN IRON BRIDGE COMPANY, East Berlin, Conn., has the contract for an extension to a factory building for the Port Chester Bolt & Nut Company, Port Chester, N. Y. The construction is to be similar to the building erected for this concern by the Berlin Company a short time ago. The supporting trusses and columns are of steel; the roof is of weave shed form, having a glass exposure on the north, which insures a large amount of light coming from the proper direction.

HARRISBURG ENGINES.—One of the most beautiful and entertaining catalogues on the subject of steam engines is that just issued by the Harrisburg Foundry & Machine Works. It is indeed a handsomely printed and profusely illustrated technical book of over 100 pages, devoted to the discussion in detail of the various types of Harrisburg engines, from the simple Ideal to the later Corliss forms, compounds, with steam accelerated valve gear. A section is devoted to boilers and the Weitmeyer patent boiler furnace. It may not be generally known that the company are in the automobile field, but they show also their steam rollers, and state that they were the first people in this country to build them.

THE NON-POLARIZING DRY BATTERY COMPANY, 625 Broadway, New York, has just received an order from the government at Washington, through Gen. A. W. Greely, for 2000 of its "O. K." dry cells for use in the Philippine Islands. In this connection it is interesting to note that the temporary telephone system established between Guantanamo Bay and Siboney during the late campaign in Cuba, was supplied with current from "O. K." dry batteries. It is stated that satisfactory results were obtained from their use. It is hardly necessary to state that a battery for use under such circumstances and conditions as these must necessarily be of proved reliability, and that the "O. K." dry battery comes within this classification is evident from the fact that it was used in Cuba and is now going to the Philippines.

THE HARVARD ELECTRIC COMPANY, 224-226 S. Clinton Street, Chicago, Ill., is experiencing the practical results of prosperous times, coupled with a record for high grade electrical specialties. With the new factory, with treble the capacity of the former works, and with new tools, together with special automatic machines, the company still finds it very difficult to supply promptly the specialties called for by its sales department. But the difficulty will soon be obviated by increased facilities. Numerous special machine tools which have been delayed by the crowded condition of the makers' factories are soon to arrive, and with these in operation it will be possible to deliver more promptly. The Standard No. 134 combination porcelain double pole fusible cut-out is receiving much attention from telephone and telegraph engineers, both at home and abroad.

MESSRS. J. G. WHITE & CO., 29 Broadway, New York, have considerable railway work in progress at the present time. They are constructing for the Washington Traction and Electric Company, Washington, D. C., about 35 miles of track and about 45 miles of overhead work. The overhead construction will all be double trolley, positive and negative, 2/0 wire being used. They are also designing and supervising the erection of a brick powerhouse for the Detroit & Lake Orion Railway Company, and are furnishing for the same two 250-hp Cahall boilers, two 300-hp Ball & Wood engines, two 200-kw direct connected Crocker-Wheeler railway generators, and one 60-kw Crocker-Wheeler booster, together with all steam and electrical accessories. They are also furnishing a 90-kw lighting generator for this plant. The firm is doing some important foreign work. They are installing a complete steam and electrical plant for generation at a central power house, and distribution to three mines of power for pumping, hoisting, etc., for the Deep Leads Transmission Company, near Melbourne, Australia. A contract at Perth, Western Australia, includes the designing and supervising of the erection of a complete steam and electrical plant for the Perth Tramways, Ltd. They also furnish all of the steam and electrical equipment for this plant, which equipment will include Brill cars, General Electric generators, Babcock & Wilcox boilers, and engines built by the Robb Engineering Company, Amherst, N. S. The Deep Leads equipment includes Babcock & Wilcox boilers, Buckeye engines and General Electric rotary field, 60-cycle alternators, with transformers and induction motors.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED JUNE 27, 1899.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

627,471. CONTROLLER FOR MOTORS; M. K. Bowen and G. W. Knox, Chicago, Ill. App. filed Nov. 7, 1898. To prevent the too sudden movement of the controller lever when turning on current, an automatically acting retarding device is applied to the cylinder shaft, the construction of such device being similar to a brake.

627,475. ELECTRIC RAILWAY; W. M. Brown, Johnstown, Pa. App. filed May 5, 1897. In that class of railway wherein non-continuous contacts are located at intervals along the roadway and normally disconnected from the source of electric supply, and in which the contacts are connected with the source of supply by a magnet carried by the car and acting upon an appropriate armature in the roadway, is used, the inventor uses two circuit closers in the form of metallic balls, one of which closes the regular working circuit when it is lifted, and the other opens a normally closed ground circuit. When the car has passed, if the first ball fails to return to its normal position to open the circuit the second one will close the ground circuit and thus render the contacts safe to persons and animals.

627,476. CONTACT BOX FOR ELECTRIC RAILWAYS; W. M. Brown, Johnstown, Pa. App. filed Sept. 30, 1898. A modification of the preceding, in which the ball works against a carbon contact and is protected from a deposit of carbon by a hood arranged over it.

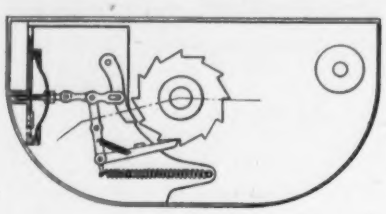
627,477. ELECTRIC RAILWAY; W. M. Brown, Johnstown, Pa. App. filed March 4, 1899. To be able to use a short magnet on the car, iron bodies are placed in the roadway which form parts of the magnetic circuit to lead the lines of force through the armature which controls the switch contacts, the invention being applied to the disconnected contact system.

627,488. FRAME OR YOKE FOR DYNAMO ELECTRIC MACHINES; C. A. Eck, Newark, N. J. App. filed Feb. 25, 1899. The inventor's idea is to do away with joints in the field circuit. The field magnet core is substantially a spherical hollow body provided with a hole large enough to put the field coil through, and enable it to be adjusted to its proper place.

627,494. STORAGE BATTERY; W. P. Freeman, New York, N. Y. App. filed June 8, 1898. The plates are provided with offset lugs which enable them to be coupled in mechanical contact with each other.

627,495. OVERHEAD TROLLEY SYSTEM; E. Frischmuth, Berlin, Germany. App. filed Feb. 17, 1899. Intersecting trolley wires are disposed in different planes along the length of track according to the potential carried, the conductors lying in the lower plane are broken at the points of intersection and held in their relative positions by insulating arches adapted to permit the passage of the trolley when in engagement with the conductors of opposite polarity.

627,502. MOTOR CONNECTING BOX FOR ELECTRIC RAILWAY VEHICLES; S. Hendrie, Detroit, Mich. App. filed Dec. 24, 1898. The controller being carried by car body and the motor or motors by truck, this inventor provides a connecting box in two parts, one of which is carried by the truck and one by the car body, so that if for any reason the car is removed



627,471.—Controller for Motors.

from the truck the disconnection and afterward the reconnection, may be effected without confusion of the circuits.

627,519. ELECTRIC CONNECTING CORD; C. H. Mackevoy, Lowell, Mass. App. filed Jan. 23, 1899. To prevent the tip of the cord from being pulled off, it is connected with the insulating cover by means of a small metallic link.

627,527. BURGLAR ALARM FOR SAFES; A. P. Prichard, Tacoma, Wash. App. filed May 2, 1898. This is a device specially adapted for use in connection with a metallic gate screen placed in front of the safe. It is arranged so that any tampering with the screen will cause an alarm to be given.

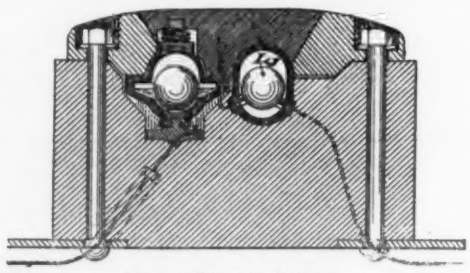
627,530. ELECTRICAL SPEED INDICATOR; A. Rape, Berlin, Germany. App. filed Aug. 19, 1898. The speed indicator is a dynamo whose voltage changes with changes in speed, a voltmeter being used for reading the speed.

627,531. DYNAMO ELECTRIC MACHINE; W. H. A. Roth, Berlin, Germany. App. filed March 11, 1899. Consists in providing a casing in association with ventilating passages in the machine, which are adapted to direct the flow of air round the heated parts and out to the external air at points distant from where it entered the machine.

627,549. ELECTRIC CONTROLLER; G. Valley, Johnstown, Pa. App. filed Jan. 7, 1897. The invention consists of an auxiliary switch surrounded by a suitable arc extinguishing medium so arranged that all making and breaking of the circuit is concentrated at the contacts of the switch.

627,577. TELEPHONE; E. F. Dunderdale, Chicago, Ill. App. filed Dec. 16, 1895. In carrying out this invention a main diaphragm is used which is directly acted upon by a magnet having coils about the ends, which coils are connected with the line, and the magnets are placed opposite the main diaphragm. Parallel with the main diaphragm is a second diaphragm centrally perforated and insulated from the main diaphragm. The idea is that the magnetic lines will be concentrated over the ends of the magnet and increase the sensitiveness of the diaphragm.

627,606. ELECTRIC ANNUNCIATOR; H. E. Thomson, Boston, Mass. App. filed March 26, 1897. The invention primarily consists in utilizing a portion



627,475.—Electric Railway.

of the metal face plate as a detent for the indicator, said portion being both an armature and a detent or simply a detent if the indicator itself be the armature.

627,641. BATTERY; V. Halski, Lemburg, Austria. App. filed Oct. 31, 1896. Two cells are arranged with feeding tubes leading to them; a swinging distributer tilts and feeds the liquid first into one tube and then into the other.

627,650. APPARATUS EMPLOYED IN WIRELESS TELEGRAPHY; G. Marconi, London, England. App. filed Jan. 5, 1899. In a previous patent to the same inventor a receiver was described in which the ends of an imperfect contact in a local circuit were connected to earth, and to an insulated conductor respectively. According to this the conductor is no longer insulated, but is connected to a capacity, which may be the earth, through the primary of an induction coil, while the ends of the imperfect contact are connected to the ends of the secondary one of the connections,, being through a condenser.

627,686. AUTOMATIC ELECTRIC SWITCH; J. L. Crevelin, New York, N. Y. App. filed Jan. 18, 1899. This switch is useful in connection with a dynamo driven from a car axle where variations of speed and changes in direction are likely to occur at any time. The main circuit contains a dynamo, a storage battery and an electromagnetic switch, the last having a coil in the main circuit and opposing coils in a derived circuit across the battery and an actuating coil in a derived circuit across the dynamo mains.

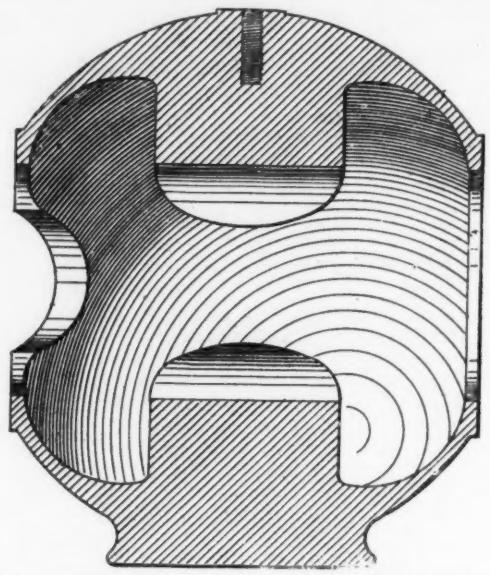
627,759. JOINT FOR ELECTRIC CONDUCTORS; H. W. Neild, London, England. App. filed Nov. 14, 1898. The joint is made by means of a sleeve, open on one side for a portion of its length, the two ends of the wires being placed in the sleeve and solder filled in.

627,772. ELECTROHYDRAULIC BRAKE FOR RAILWAY VEHICLES; C. Durey, Paris, France. App. filed Jan. 5, 1899. Improvements in the details of construction of a railway brake where the power is hydraulic and controlled by electrically operated valves.

627,784. CONDUIT FOR ELECTRIC CONDUCTORS; C. Sewall, Chicago, Ill. App. filed April 24, 1899. By this invention the conduits are formed within the material of the street pavement itself, being supported within or upon the foundation of the pavement and immediately beneath the stones, asphalt or other material of the roadway.

627,799. TELEGRAPHIC SOUNDER; J. H. Bunnell, New York, N. Y. App. filed Aug. 31, 1898. The sounder has a compound base made of three or more interconnected plates, one plate being of wood and rigidly held between the others and in such a manner that the edges of all of them shall be free to vibrate, the lower plate of the set being of metal to protect the others.

627,813. TELEPHONE CIRCUIT AND SWITCH APPARATUS; T. C. Wales, Jr., Newton, Mass. App. filed March 14, 1899. The object is to pro-



627,488.—Frame or Yoke for Dynamo Electric Machines.

vide means whereby a high electromotive force may be made use of for the metallic circuits and a low electromotive force for the grounded lines.

627,820. SANITARY GUARD FOR TELEPHONE TRANSMITTERS AND RECEIVERS; E. B. Doolittle and E. Everit, New Haven, Conn. App. filed March 1, 1899. The device consists of a body adapted to fit within the mouthpiece of the instrument. Its inner end is closed by a very thin diaphragm which prevents the outward passage of bacilli from the diaphragm into the mouth of the user.

627,837. ELECTRIC CIRCUIT CLOSING DEVICE; F. Wilkie, Akron, Ohio. App. filed April 8, 1899. A thermostatic device in which the invention resides in the details of construction.

627,908. ELECTRICAL MEASURING INSTRUMENT; H. P. Davis and F. Conrad, Wilkinsburg, Pa. App. filed April 1, 1899. The instrument is provided with a permanent magnet having curved polar extensions superimposed in parallel planes and separated by an air gap. In connection with this is a shell and damper plate, the latter located between the polar extensions and the shell arranged to surround one of said extensions and provided with an actuating coil and an indicating device.

627,917. DRY CELL; M. E. Fuld, Baltimore, Md. App. filed Jan. 31, 1899. The carbon electrode is provided with a transverse opening in its upper end through which the sealing material passes.

627,927. CONTINUOUS CONTACT TROLLEY; C. B. Lebcher, Plains, Mont. App. filed Aug. 22, 1898. The invention comprises a supplemental trolley in the rear of the main trolley, which is normally above the wire and resting upon the top thereof, but when obstructions are met, as a hanger, a cross wire, it is automatically brought underneath and in contact with the underside of the feed wire.

627,937. DYNAMO ELECTRIC MACHINE; E. Liber, Los Angeles, Cal. App. filed Feb. 22, 1899. To prevent sparking this inventor purposes using brushes, the contact face of each of which is of a width less than that of all the commutator bars of one polarity which connect with series or groups of the winding, and greater than that of all of said bars less one, the relation of the brushes to the bars with which they respectively in contact being uniform throughout the winding.

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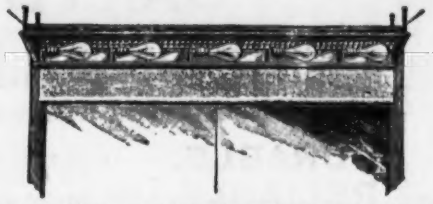

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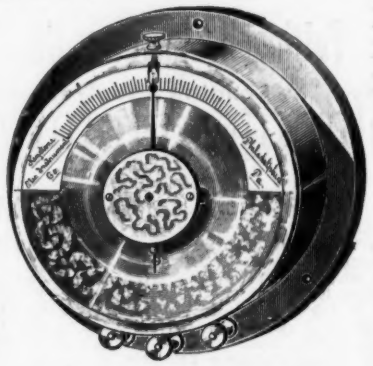

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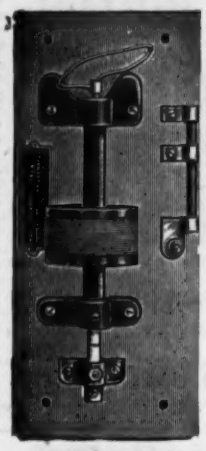

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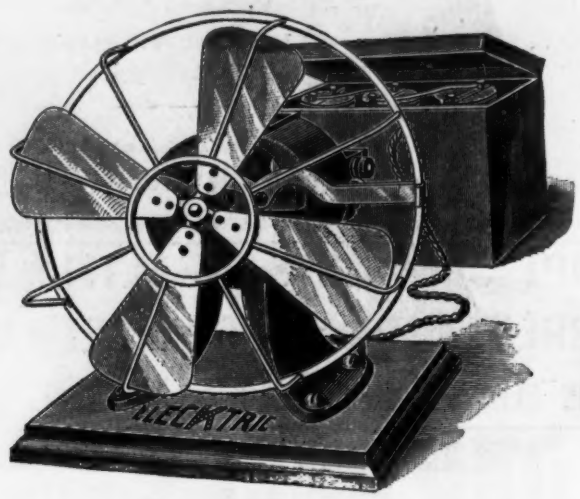

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